

# IDAHO DEPARTMENT OF FISH AND GAME

Jerry M. Conley, Director

FEDERAL AID IN FISH RESTORATION  
Job Performance Report  
Project F-71-R-16



## REGIONAL FISHERIES MANAGEMENT INVESTIGATIONS

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## JOB PERFORMANCE REPORT

State of: Idaho Name: Regional Fishery Management  
Investigations

Project No.: F-71-R-16 Title: Region 1 Mountain Lakes  
Investigations

Job No.: 1-a

Period Covered: July 1, 1991 to June 30, 1992

### ABSTRACT

During 1991, management personnel coordinated with hatchery personnel, Conservation Officers, sportsmen, and the Forest Service to manage mountain lakes in Region 1. Westslope cutthroat trout Oncorhynchus clarki lewisi were stocked in 23 lakes, Kamloops rainbow trout O. mykiss in 4, grayling Thymallus arcticus in 5, and 1 lake received brook trout Salvelinus fontinalis. Drive-to lakes received put-and-take rainbow trout of the Mt. Lassen, Hayspur, and Eagle Lake strains. Mountain lake stockings in Region 1 are summarized for the past 11 years.

Revett and Glidden lakes were surveyed in 1991 to assess limnological and biological conditions. Public meetings were held to determine management preferences for mountain lakes in the upper Coeur d'Alene River drainage. Bull trout S. confluentus will be stocked to act as a biological control for stunted brook trout. Harvest will be evaluated to determine if increased bag limits would result in significant reductions to brook trout populations in these lakes.

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## OBJECTIVES

1. To develop improved management plans for fish populations in mountain lakes in Region 1.
2. To evaluate limnological conditions in selected mountain lakes, their fish populations, angler satisfaction, and preferences. Use new and existing information on angler use, water quality, species history, spawning potential, stocking success, and lake morphology to develop the potential of these waters for providing diverse angling experiences.

## INTRODUCTION

### Mountain Lake Surveys

Mountain lake fishing in Idaho produces the highest angler satisfaction ratings. The opportunity to fish in a pristine setting with family and friends for a variety of salmonid species all contribute to the satisfaction of the angler. Most mountain lakes in Region 1 that will support fish populations are maintained by stocking fry. Westslope cutthroat trout *Oncorhynchus clarki lewisi* and rainbow trout *O. mykiss* are utilized in most lakes, although some lakes are stocked with golden trout *O. aquabonita* and grayling *Thymallus arcticus* to provide diversity. Lakes containing naturally-reproducing brook trout *Salvelinus fontinalis* populations are not stocked.

Most of the lakes in the South Fork of the Coeur d'Alene River drainage, including Revett and Upper Glidden lakes, contain stunted brook trout populations. These lakes were surveyed in 1991 to evaluate the potential for providing an alternative fishery.

## METHODS

Information on mountain lakes in Region 1 was reviewed with hatchery personnel and individuals from other agencies and groups to coordinate releases of fish in 1991. The stocking program was based on previous history, reports of fishing quality, and availability of fish for release in 1991.

Brook trout in Revett and Upper Glidden lakes were sampled with two gill nets of six panels each ranging in mesh from 19 mm to 68 mm bar mesh of #3 monofilament. Nets were set in each lake for a total of 20 hours. Nets were set from a one-man rubber raft from which we also recorded Secchi transparency depth, lake depth, temperature profiles, conductivity, and pH.

## RESULTS AND DISCUSSION

The mountain lake stocking program for 1991 was completed with minimal changes. The majority of lakes (23 in 1991) were stocked with westslope cutthroat trout. Antelope and Solomon lakes were stocked with fingerling and surplus cutthroat trout broodstock. Only Callahan Lake was not stocked as scheduled due to the access road being washed out. This lake was last stocked in 1988.

All lakes scheduled for rainbow trout in 1991 received fish, but the stock of rainbow varied. Domestic Kamloops rainbow were stocked in four lakes in the Kootenai River drainage. Mt. Lassen rainbow were stocked in three lakes in the Spokane and Little North Fork Clearwater River drainages as a substitute for domestic Kamloops. Drive-to lakes received put-and-take rainbow of the Hayspur and Eagle Lake strains.

Only grayling were available in 1991, and five lakes were stocked. Golden trout remain difficult to obtain, so grayling have been utilized as a substitute specialty fish.

Bloom Lake continues to be stocked with fingerling brook trout. Brown trout Salmo trutta of a suitable size were not available for stocking in 1991. Stocking histories for the past 11 years for Region 1 mountain lakes are summarized in Table 1.

Not enough creel census data was available in 1991 to evaluate program goals.

The stocking schedule for Region 1 mountain lakes attempts to balance the number of each species of fish and the number of lakes to be stocked each year (Tables 2 and 3). Deviations from the schedule have most often been caused by lack of fish, lack of proper sized fish (too large at stocking time), access problems, or conflicts with other hatchery programs. Lakes in the Little North Fork Clearwater drainage were stocked by plane from the McCall Hatchery in 1991.

Species diversity will be maintained by utilizing westslope cutthroat and domestic Kamloops rainbow for most lakes, golden and grayling (when available) for specialty lakes, and brown trout for attempted control of stunted brook trout. Bull trout S. confluentus may be used to control brook trout if hatchery surpluses are available.

The lack of suitable sized domestic Kamloops rainbow has forced us to utilize different stocks of rainbow trout in order to maintain some species diversity in mountain lakes. Rainbow trout will not be stocked in mountain lakes in the Pend Oreille drainage to avoid diluting the wild Gerrard rainbow gene pool in Lake Pend Oreille, and we will stock only westslope cutthroat in lakes specified for cutthroat.

The summary of data collected in Revett and Upper Glidden is given in Table 4. A total of 25 and 17 brook trout were collected from Revett Lake and Upper Glidden Lake, respectively. Mean length of brook trout was 191 mm (range 140-368 mm) in Revett Lake and 169 mm (range 100-249 mm) in Upper Glidden Lake.

Brook trout in Revett and Upper Glidden lakes displayed the typical characteristics for stunted trout; large heads and small bodies. Methods to improve a stunted trout population include increase fishing pressure, stock a salmonid piscivore, or eradicate the brook trout population using rotenone then restocking with a more desirable species.

Increasing fishing pressure on small fish is very difficult unless some type of incentive is offered to the angler (e.g. increase bag limit). Trail improvement will make hiking to the lake easier. Advertisement increases public awareness, but a combination of all of these may be necessary to increase fishing pressure.

Introduction of a fish predator, such as bull trout, lake trout, brown trout, or chinook salmon, has been used to improve the condition of stunted brook trout populations (Nelson 1988). The proper predator-prey ratio can result in reduction in the number of stunted fish which can improve growth rates of the remaining trout. A predator can also provide a trophy fishery. Length of the

Table 1. Number and species of fish (fry except where noted) stocked into mountain lakes in Region 1 from 1981-1992.

| Drainage | Lake                           | Surface acres | Year stocked | Number stocked | Stocking rate (fish/acre) | Stock of fish         | Comments |
|----------|--------------------------------|---------------|--------------|----------------|---------------------------|-----------------------|----------|
| Kootenai | Hidden (1-103)                 | 50            | 1981         | 15,922         | 318                       | westslope cutthroat   |          |
|          |                                |               | 1982         | 15,656         | 313                       | Kamloops rainbow      |          |
|          |                                |               | 1983         | 12,107         | 242                       | Henrys Lake cutthroat |          |
|          |                                |               | 1984         | 12,768         | 255                       | Kamloops rainbow      |          |
|          |                                |               | 1985         | 12,512         | 250                       | westslope cutthroat   |          |
|          |                                |               | 1986         | 6,000          | 120                       | westslope cutthroat   |          |
|          |                                |               | 1987         | 12,500         | 250                       | westslope cutthroat   |          |
|          |                                |               | 1988         | 12,096         | 242                       | Kamloops rainbow      |          |
|          |                                |               | 1989         | 3,082          | 62                        | Kamloops rainbow      |          |
|          |                                |               | 1989         | 12,495         | 250                       | westslope cutthroat   |          |
|          |                                |               | 1990         | 12,928         | 258                       | Kamloops rainbow      |          |
|          |                                |               | 1991         | 12,500         | 250                       | westslope cutthroat   |          |
|          |                                |               | 1992         | 8,440          | 169                       | Kamloops rainbow      |          |
|          | Lake Mountain (Cutoff) (1-104) | 7             | 1983         | 1,723          | 246                       | Henrys Lake cutthroat |          |
|          |                                |               | 1985         | 1,748          | 250                       | westslope cutthroat   |          |
|          |                                |               | 1987         | 1,750          | 250                       | westslope cutthroat   |          |
|          |                                |               | 1989         | 1,750          | 250                       | westslope cutthroat   |          |
|          |                                |               | 1991         | 1,750          | 250                       | westslope cutthroat   |          |
|          | West Fork (1-109)              | 12            | 1981         | 6,704          | 559                       | westslope cutthroat   |          |
|          |                                |               | 1982         | 3,648          | 304                       | Kamloops rainbow      |          |
|          |                                |               | 1983         | 3,016          | 251                       | Henrys Lake cutthroat |          |
|          |                                |               | 1984         | 3,010          | 251                       | Kamloops rainbow      |          |
|          |                                |               | 1985         | 2,990          | 250                       | westslope cutthroat   |          |
|          |                                |               | 1986         | 4,495          | 375                       | westslope cutthroat   |          |
|          |                                |               | 1987         | 3,000          | 250                       | westslope cutthroat   |          |
|          |                                |               | 1988         | 3,007          | 250                       | westslope cutthroat   |          |
|          |                                |               | 1989         | 3,087          | 257                       | Kamloops rainbow      |          |
|          |                                |               | 1990         | 3,000          | 250                       | westslope cutthroat   |          |
|          |                                |               | 1991         | 3,000          | 250                       | Kamloops rainbow      |          |
|          |                                |               | 1992         | 3,000          | 250                       | westslope cutthroat   |          |
|          | Long Mountain (1-112)          | 3             | 1987         | 1,000          | 333                       | Grayling              |          |
|          |                                |               | 1990         | 1,500          | 500                       | Grayling              |          |
|          |                                |               | 1991         | 1,500          | 500                       | Grayling              |          |
|          |                                |               | 1992         | 664            | 331                       | Grayling              |          |



Table 1. Continued.

| Drainage | Lake                        | Surface acres | Year stocked | Number stocked | Stocking rate (fish/acre) | Stock of fish         | Comments |
|----------|-----------------------------|---------------|--------------|----------------|---------------------------|-----------------------|----------|
| Kootenai | Parker (1-113)              | 3             | 1986         | 1,225          | 408                       | Golden trout          |          |
|          |                             |               | 1988         | 1,002          | 334                       | Grayling              |          |
|          |                             |               | 1990         | 1,410          | 470                       | Golden trout          |          |
|          |                             |               | 1991         | 1,500          | 500                       | Grayling              |          |
|          |                             |               | 1992         | 265            | 122                       | Grayling              |          |
|          |                             |               |              |                |                           |                       |          |
|          | Smith (Long Canyon) (1-115) | 6             | 1987         | 2,000          | 333                       | Grayling              |          |
|          |                             |               | 1988         | 3,000          | 500                       | Grayling              |          |
|          |                             |               | 1990         | 3,000          | 500                       | Grayling              |          |
|          |                             |               | 1991         | 1,000          | 167                       | Grayling              |          |
|          | Big Fisher (1-117)          | 10            | 1981         | 3,352          | 335                       | Westslope cutthroat   |          |
|          |                             |               | 1983         | 2,486          | 248                       | Henrys Lake cutthroat |          |
|          |                             |               | 1985         | 2,530          | 253                       | Westslope cutthroat   |          |
|          |                             |               | 1987         | 2,500          | 250                       | Westslope cutthroat   |          |
|          |                             |               | 1990         | 2,500          | 250                       | Westslope cutthroat   |          |
|          |                             |               | 1992         | 2,500          | 250                       | Westslope cutthroat   |          |
|          | Myrtle (1-122)              | 20            | 1983         | 5,189          | 259                       | Westslope cutthroat   |          |
|          |                             |               | 1985         | 5,100          | 255                       | Westslope cutthroat   |          |
|          |                             |               | 1987         | 5,000          | 250                       | Westslope cutthroat   |          |
|          |                             |               | 1989         | 5,000          | 250                       | Westslope cutthroat   |          |
|          |                             |               | 1991         | 4,953          | 248                       | Westslope cutthroat   |          |
|          | Trout (1-124)               | 7             | 1981         | 2,514          | 359                       | Westslope cutthroat   |          |
|          |                             |               | 1982         | 3,296          | 471                       | Kamloops rainbow      |          |
|          |                             |               | 1983         | 1,720          | 247                       | Henrys Lake cutthroat |          |
|          |                             |               | 1984         | 1,733          | 248                       | Kamloops rainbow      |          |
|          |                             |               | 1985         | 1,748          | 250                       | Westslope cutthroat   |          |
|          |                             |               | 1986         | 1,721          | 246                       | Westslope cutthroat   |          |
|          |                             |               | 1987         | 1,751          | 250                       | Westslope cutthroat   |          |
|          |                             |               | 1988         | 1,743          | 250                       | Westslope cutthroat   |          |
|          |                             |               | 1990         | 1,750          | 250                       | Westslope cutthroat   |          |
|          |                             |               | 1992         | 1,750          | 250                       | Kamloops rainbow      |          |
|          |                             |               |              |                |                           |                       |          |
|          |                             |               |              |                |                           |                       |          |

Table 1. Continued.

| Drainage | Lake                         | Surface<br>acres | Year<br>stocked | Number<br>stocked | Stocking rate<br>(fish/acre) | Stock of fish                | Comments |
|----------|------------------------------|------------------|-----------------|-------------------|------------------------------|------------------------------|----------|
| Kootenai | Pyramid<br>(1-125)           | 11               | 1981            | 4,190             | 381                          | westslope cutthroat          |          |
|          |                              |                  | 1982            | 3,296             | 300                          | Kamloops rainbow             |          |
|          |                              |                  | 1983            | 2,702             | 246                          | Henrys Lake cutthroat        |          |
|          |                              |                  | 1984            | 2,736             | 249                          | Kamloops rainbow             |          |
|          |                              |                  | 1985            | 2,760             | 251                          | westslope cutthroat          |          |
|          |                              |                  | 1986            | 2,741             | 249                          | westslope cutthroat          |          |
|          |                              |                  | 1987            | 2,750             | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1988            | 2,752             | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1989            | 2,750             | 250                          | Kamloops rainbow             |          |
|          |                              |                  | 1990            | 2,765             | 251                          | westslope cutthroat          |          |
|          |                              |                  | 1991            | 2,750             | 250                          | Kamloops rainbow             |          |
|          |                              |                  | 1992            | 2,750             | 250                          | westslope cutthroat          |          |
|          | Ball Creek<br>(1-126)        | 6                | 1983            | 1,513             | 255                          | Henry Lake cutthroat         |          |
|          |                              |                  | 1984            | 1,000             | 167                          | westslope cutthroat          |          |
|          |                              |                  | 1986            | 1,498             | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1988            | 1,500             | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1990            | 1,500             | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1992            | 1,500             | 250                          | westslope cutthroat          |          |
|          | Little Ball Creek<br>(1-127) | 4                | 1984            | 1,500             | 375                          | westslope cutthroat          |          |
|          |                              |                  | 1986            | 956               | 239                          | westslope cutthroat          |          |
|          |                              |                  | 1988            | 1,000             | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1990            | 1,000             | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1992            | 1,000             | 250                          | westslope cutthroat          |          |
|          | Snow<br>(1-134)              | 10               | 1982            | 3,008             | 301                          | westslope cutthroat          |          |
|          |                              |                  | 1983            | 2,872             | 287                          | Henrys Lake cutthroat        |          |
|          |                              |                  | 1987            | 2,500             | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1989            | 2,400             | 240                          | westslope cutthroat          |          |
|          |                              |                  | 1991            | 2,500             | 250                          | westslope cutthroat          |          |
|          | Roman Nose #3<br>(1-137)     | 12               | 1983            | 2,320             | 193                          | Domestic Kamloops (size 2)   |          |
|          |                              |                  | 1985            | 3,00              | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1986            | 3,000             | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1987            | 3,000             | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1988            | 3,000             | 250                          | westslope cutthroat          |          |
|          |                              |                  | 1989            | 3,000             | 250                          | Kamloops rainbow             |          |
|          |                              |                  | 1990            | 1,000             | 83                           | westslope cutthroat (size 2) |          |
|          |                              |                  | 1991            | 3,150             | 262                          | Kamloops rainbow             |          |
|          |                              |                  | 1992            | 1,305             | 109                          | westslope cutthroat (size 2) |          |

Table 1. Continued.

| Drainage | Lake               | Surface<br>acres | Year<br>stocked | Number<br>stocked | Stocking rate<br>(fish/acre) | Stock of fish                    | Comments |
|----------|--------------------|------------------|-----------------|-------------------|------------------------------|----------------------------------|----------|
| Kootenai | Solomon<br>(1-146) | 9                | 1982            | 3,040             | 338                          | Kamloops rainbow                 |          |
|          |                    |                  | 1983            | 2,162             | 240                          | Henrys Lake cutthroat            |          |
|          |                    |                  | 1984            | 2,268             | 252                          | Kamloops rainbow                 |          |
|          |                    |                  | 1985            | 2,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1986            | 2,500             | 278                          | westslope cutthroat              |          |
|          |                    |                  | 1987            | 2,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1988            | 2,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1989            | 712               | 79                           | westslope cutthroat (broodstock) |          |
|          |                    |                  | 1990            | 2,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1991            | 1,024             | 114                          | westslope cutthroat (size 2)     |          |
|          |                    |                  | 1991            | 480               | 53                           | westslope cutthroat (broodstock) |          |
|          |                    |                  | 1992            | 1,045             | 116                          | westslope cutthroat (size 2)     |          |
|          | Spruce<br>(1-147)  | 5                | 1982            | 2,432             | 486                          | Kamloops rainbow                 |          |
|          |                    |                  | 1983            | 1,297             | 259                          | Henrys Lake cutthroat            |          |
|          |                    |                  | 1984            | 2,520             | 504                          | Kamloops rainbow                 |          |
|          |                    |                  | 1985            | 1,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1986            | 1,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1987            | 1,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1988            | 1,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1989            | 1,265             | 253                          | westslope cutthroat              |          |
|          |                    |                  | 1990            | 1,250             | -250                         | westslope cutthroat              |          |
|          |                    |                  | 1991            | 1,247             | 250                          | Kamloops rainbow                 |          |
|          | Queen<br>(1-148)   | 5                | 1983            | 1,296             | 259                          | Henrys Lake cutthroat            |          |
|          |                    |                  | 1986            | 1,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1988            | 1,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1990            | 1,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1992            | 1,250             | 250                          | westslope cutthroat              |          |
|          | Debt<br>(1-150)    | 5                | 1985            | 1,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1989            | 1,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1991            | 1,250             | 250                          | westslope cutthroat              |          |
|          | Copper<br>(1-154)  | 5                | 1983            | 1,297             | 259                          | Henrys Lake cutthroat            |          |
|          |                    |                  | 1984            | 1,390             | 278                          | westslope cutthroat              |          |
|          |                    |                  | 1986            | 1,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1988            | 1,247             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1990            | 1,250             | 250                          | westslope cutthroat              |          |
|          |                    |                  | 1992            | 1,250             | 250                          | westslope cutthroat              |          |

Table 1. Continued.

| Drainage        | Lake                        | Surface<br>acres | Year<br>stocked | Number<br>stocked | Stocking rate<br>(fish/acre) | Stock of fish         | Comments                                    |
|-----------------|-----------------------------|------------------|-----------------|-------------------|------------------------------|-----------------------|---|
| <u>Kootenai</u> | Callahan (Smith)<br>(1-166) | 10               | 1984            | 2,500             | 250                          | westslope cutthroat   |   |
|                 |                             |                  | 1987            | 2,522             | 252                          | westslope cutthroat   |   |
|                 |                             |                  | 1988            | 2,500             | 250                          | westslope cutthroat   |   |
|                 |                             |                  | 1992            | 2,563             | 251                          | westslope cutthroat   |   |
|                 | Estelle<br>(1-167)          | 5                | 1988            | 1,075             | 215                          | Brown trout           | Test control of stunted<br>brook trout.     |
|                 |                             |                  | 1990            | 500               | 100                          | Brown trout (size 3)  |   |
|                 |                             |                  | 1992            | 150               | 30                           | Brown trout (size 2)  |   |
|                 | Hunt<br>(2-101)             | 12               | 1982            | 3,648             | 304                          | Kamloops rainbow      |   |
|                 |                             |                  | 1985            | 3,000             | 250                          | westslope cutthroat   |   |
|                 |                             |                  | 1986            | 3,000             | 250                          | westslope cutthroat   |   |
|                 |                             |                  | 1987            | 3,033             | 253                          | westslope cutthroat   |   |
|                 |                             |                  | 1988            | 3,000             | 250                          | westslope cutthroat   |   |
|                 |                             |                  | 1989            | 5,000             | 417                          | westslope cutthroat   |   |
|                 |                             |                  | 1990            | 3,000             | 250                          | westslope cutthroat   |   |
|                 |                             |                  | 1991            | 3,000             | 250                          | westslope cutthroat   |   |
|                 |                             |                  | 1992            | 3,023             | 250                          | westslope cutthroat   |   |
|                 | Standard<br>(2-103)         | 16               | 1983            | 4,021             | 251                          | Henrys Lake cutthroat |   |
|                 |                             |                  | 1985            | 4,000             | 250                          | westslope cutthroat   |   |
|                 |                             |                  | 1987            | 3,962             | 248                          | westslope cutthroat   |   |
|                 |                             |                  | 1989            | 4,000             | 250                          | westslope cutthroat   |   |
|                 |                             |                  | 1991            | 4,000             | 250                          | westslope cutthroat   |   |
|                 | Two Mouth #1<br>(2-106)     |                  | 1981            | 2,258             |                              | westslope cutthroat   | Discontinue stocking due<br>to winter kill. |
|                 | Two Mouth #2<br>(2-107)     | 5                | 1981            | 2,258             | 452                          | westslope cutthroat   |   |
|                 |                             |                  | 1983            | 2,054             | 411                          | Henrys Lake cutthroat |   |
|                 |                             |                  | 1985            | 1,265             | 253                          | westslope cutthroat   |   |
|                 |                             |                  | 1987            | 1,269             | 254                          | westslope cutthroat   |   |
|                 |                             |                  | 1989            | 1,265             | 253                          | westslope cutthroat   |   |
|                 |                             |                  | 1991            | 1,250             | 250                          | westslope cutthroat   |   |

Table 1. Continued.

| Drainage     | Lake                                     | Surface acres | Year stocked | Number stocked | Stocking rate (fish/acre) | Stock of fish         | Comments                              |
|--------------|--|---------------|--------------|----------------|---------------------------|-----------------------|---------------------------------------|
| Pend Oreille | Two Mouth #3<br>(2-108)                  | 20            | 1981         | 6,774          | 339                       | westslope cutthroat   |                                       |
|              |  |               | 1983         | 4,973          | 249                       | Henrys Lake cutthroat |                                       |
|              |  |               | 1984         | 5,280          | 264                       | westslope cutthroat   |                                       |
|              |  |               | 1986         | 5,000          | 250                       | westslope cutthroat   |                                       |
|              |  |               | 1988         | 5,000          | 250                       | westslope cutthroat   |                                       |
|              |  |               | 1990         | 5,000          | 250                       | westslope cutthroat   |                                       |
|              |  |               | 1992         | 5,000          | 250                       | westslope cutthroat   |                                       |
|              | Mollies<br>(2-114)                       | 2             | 1981         | 3,352          | 1,672                     | westslope cutthroat   |                                       |
|              |  |               | 1983         | 648            | 324                       | Henrys Lake cutthroat |                                       |
|              |  |               | 1985         | 506            | 253                       | westslope cutthroat   |                                       |
|              |  |               | 1987         | 508            | 254                       | westslope cutthroat   |                                       |
|              |  |               | 1989         | 500            | 250                       | westslope cutthroat   |                                       |
|              |  |               | 1991         | 500            | 250                       | westslope cutthroat   |                                       |
|              | Caribou<br>(near West Fk Mtn)<br>(2-116) | 6.8           | 1984         | 1,752          | 258                       | Henrys Lake cutthroat |                                       |
|              |  |               | 1986         | 1,750          | 257                       | westslope cutthroat   |                                       |
|              |  |               | 1987         | 1,750          | 257                       | westslope cutthroat   |                                       |
|              |  |               | 1988         | 1,750          | 257                       | westslope cutthroat   |                                       |
|              |  |               | 1990         | 1,750          | 257                       | westslope cutthroat   |                                       |
|              |  |               | 1992         | 1,750          | 257                       | westslope cutthroat   |                                       |
|              | Fault<br>(Hunt Peak #1)<br>(2-121)       | 6             | 1981         | 2,258          | 376                       | westslope cutthroat   |                                       |
|              |  |               | 1983         | 2,872          | 478                       | Henrys Lake cutthroat |                                       |
|              |  |               | 1985         | 1,500          | 250                       | westslope cutthroat   |                                       |
|              |  |               | 1987         | 1,500          | 250                       | westslope cutthroat   |                                       |
|              |  |               | 1989         | 1,553          | 259                       | westslope cutthroat   |                                       |
|              |  |               | 1991         | 2,275          | 379                       | westslope cutthroat   | Received McCormick Lake fish as well. |
|              | McCormick<br>(Hunt Peak #2)<br>(2-122)   | 3.1           | 1981         | 2,258          | 728                       | westslope cutthroat   |                                       |
|              |  |               | 1985         | 780            | 252                       | westslope cutthroat   |                                       |
|              |  |               | 1987         | 775            | 250                       | westslope cutthroat   |                                       |
|              |  |               | 1989         | 805            | 260                       | westslope cutthroat   |                                       |
|              |  |               | 1991         | 816            | 263                       | westslope cutthroat   |                                       |
|              | Little Harrison<br>(2-126)               | 6.5           | 1981         | 2,258          | 347                       | westslope cutthroat   |                                       |
|              |  |               | 1983         | 1,651          | 254                       | Henrys Lake cutthroat |                                       |
|              |  |               | 1987         | 1,625          | 250                       | westslope cutthroat   |                                       |
|              |  |               | 1988         | 1,625          | 250                       | westslope cutthroat   |                                       |
|              |  |               | 1990         | 1,625          | 250                       | westslope cutthroat   |                                       |
|              |  |               | 1992         | 1,625          | 250                       | westslope cutthroat   |                                       |

Table 1. Continued.

| Drainage            | Lake             | Surface acres | Year stocked | Number stocked | Stocking rate (fish/acre) | Stock of fish         | Comments                               |
|---------------------|------------------|---------------|--------------|----------------|---------------------------|-----------------------|--|
| <u>Pend Oreille</u> | Beehive (2-128)  | 7             | 1981         | 2,258          | 323                       | Weststope cutthroat   |  |
|                     |                  |               | 1983         | 1,723          | 246                       | Henrys Lake cutthroat |  |
|                     |                  |               | 1985         | 1,740          | 248                       | Weststope cutthroat   |  |
|                     |                  |               | 1986         | 1,803          | 258                       | Weststope cutthroat   |  |
|                     |                  |               | 1987         | 1,750          | 250                       | Weststope cutthroat   |  |
|                     |                  |               | 1989         | 2,164          | 309                       | Weststope cutthroat   |  |
|                     |                  |               | 1991         | 1,750          | 250                       | Weststope cutthroat   |  |
|                     | Harrison (2-129) | 29            | 1981         | 9,218          | 318                       | Westslope cutthroat   |  |
|                     |                  |               | 1982         | 6,972          | 240                       | Kamloops rainbow      |  |
|                     |                  |               | 1983         | 7,243          | 250                       | Henrys Lake cutthroat |  |
|                     |                  |               | 1984         | 7,296          | 250                       | Kamloops rainbow      |  |
|                     |                  |               | 1985         | 7,200          | 248                       | Westslope cutthroat   |  |
|                     |                  |               | 1986         | 6,870          | 237                       | Weststope cutthroat   |  |
|                     |                  |               | 1987         | 7,264          | 250                       | Weststope cutthroat   |  |
|                     |                  |               | 1988         | 7,250          | 250                       | Weststope cutthroat   |  |
|                     |                  |               | 1989         | 7,479          | 258                       | Weststope cutthroat   |  |
|                     |                  |               | 1990         | 7,250          | 250                       | Westslope cutthroat   |  |
|                     |                  |               | 1991         | 7,246          | 250                       | Weststope cutthroat   |  |
|                     |                  |               | 1992         | 7,250          | 250                       | Westslope cutthroat   |  |
|                     | Beaver (2-130)   | 5             | 1990         | 500            | 100                       | Brown trout (size 3)  | Test control of stunted brook trout.   |
|                     |                  |               | 1992         | 150            | 30                        | Brown trout (size 2)  |  |
|                     | Dennick (2-171)  | 8             | 1981         | 5,800          | 725                       | Westslope cutthroat   |  |
|                     |                  |               | 1983         | 1,939          | 242                       | Henrys Lake cutthroat |  |
|                     |                  |               | 1984         | 2,060          | 258                       | Weststope cutthroat   |  |
|                     |                  |               | 1985         | 2,010          | 251                       | Westslope cutthroat   |  |
|                     |                  |               | 1986         | 2,500          | 312                       | Weststope cutthroat   |  |
|                     |                  |               | 1987         | 2,000          | 250                       | Westslope cutthroat   |  |
|                     |                  |               | 1988         | 2,000          | 250                       | Weststope cutthroat   |  |
|                     |                  |               | 1989         | 2,064          | 258                       | Weststope cutthroat   |  |
|                     |                  |               | 1990         | 2,000          | 250                       | Westslope cutthroat   |  |
|                     |                  |               | 1991         | 2,000          | 250                       | Weststope cutthroat   |  |
|                     |                  |               | 1992         | 2,000          | 250                       | Westslope cutthroat   |  |
|                     |                  |               | 1992         | 150            | 19                        | Brown trout           | Stocked by mistake (helicopter plant). |
|                     |                  |               |              |                |                           |                       |  |

Table 1. Continued.

| Drainage            | Lake              | Surface acres | Year stocked | Number stocked | Stocking rate (fish/acre) | Stock of fish               | Comments            |
|---------------------|-------------------|---------------|--------------|----------------|---------------------------|-----------------------------|---------------------|
| <u>Pend Oreille</u> | Sand (2-172)      | 5             | 1981         | 3,480          | 696                       | Westslope cutthroat         |                     |
|                     |                   |               | 1982         | 8,360          | 1,672                     | Kokanee                     |                     |
|                     |                   |               | 1983         | 1,221          | 244                       | Henrys Lake cutthroat       |                     |
|                     |                   |               | 1984         | 1,254          | 251                       | Westslope cutthroat         |                     |
|                     |                   |               | 1985         | 1,260          | 252                       | Westslope cutthroat         |                     |
|                     |                   |               | 1986         | 1,250          | 250                       | Westslope cutthroat         |                     |
|                     |                   |               | 1987         | 1,250          | 250                       | Westslope cutthroat         |                     |
|                     |                   |               | 1988         | 1,247          | 250                       | Westslope cutthroat         |                     |
|                     |                   |               | 1989         | 1,250          | 250                       | Westslope cutthroat         |                     |
|                     |                   |               | 1990         | 1,250          | 250                       | Westslope cutthroat         |                     |
|                     |                   |               | 1991         | 1,250          | 250                       | Westslope cutthroat         |                     |
|                     |                   |               | 1992         | 1,250          | 250                       | Westslope cutthroat         |                     |
|                     | Bloom (2-173)     | 20            | 1981         | 24,402         | 1,220                     | Brook trout                 |                     |
|                     |                   |               | 1982         | 10,620         | 531                       | Brook trout                 |                     |
|                     |                   |               | 1984         | 5,041          | 252                       | Brook trout                 |                     |
|                     |                   |               | 1985         | 4,599          | 230                       | Brook trout                 |                     |
|                     |                   |               | 1986         | 5,360          | 268                       | Brook trout                 |                     |
|                     |                   |               | 1987         | 5,000          | 250                       | Brook trout                 |                     |
|                     |                   |               | 1988         | 5,000          | 250                       | Brook trout                 |                     |
|                     |                   |               | 1989         | 5,000          | 250                       | Brook trout                 |                     |
|                     |                   |               | 1990         | 10,013         | 500                       | Brook trout                 |                     |
|                     |                   |               | 1990         | 500            | 25                        | Splake (size 2)             |                     |
|                     |                   |               | 1991         | 4,000          | 200                       | Brook trout                 |                     |
|                     |                   |               | 1992         | 5,000          | 250                       | Brook trout                 |                     |
|                     |                   |               | 1992         | 2,000          | 100                       | Westslope cutthroat         | Stocked by mistake  |
|                     |                   |               | 1992         | 500            | 25                        | Splake (size 3)             | (helicopter plant). |
|                     | Porcupine (2-182) | 13            | 1982         | 1,296          | 100                       | Kamloops rainbow            |                     |
|                     |                   |               | 1983         | 2,872          | 220                       | Domestic Kamloops (size 2)  |                     |
|                     |                   |               | 1984         | 1,016          | 78                        | Catchable rainbow           |                     |
|                     |                   |               | 1985         | 1,000          | 77                        | Catchable rainbow           |                     |
|                     |                   |               | 1986         | 1,075          | 83                        | Mt. Lassen rainbow (size 3) |                     |
|                     |                   |               | 1987         | --             | --                        | --                          | Road washed out.    |
|                     |                   |               | 1988         | 600            | 46                        | Mt. Lassen rainbow (size 3) |                     |
|                     |                   |               | 1989         | 690            | 53                        | Mt. Lassen rianbow (size 3) |                     |
|                     |                   |               | 1990         | 750            | 58                        | Catchable rainbow           |                     |
|                     |                   |               | 1991         | --             | --                        | --                          | Road washed out.    |

Table 1. Continued.

| Drainage            | Lake                                    | Surface<br>acres | Year<br>stocked | Number<br>stocked | Stocking rate<br>(fish/acre) | Stock of fish                                 | Comments                                      |
|---------------------|---|------------------|-----------------|-------------------|------------------------------|---|---|
| <u>Pend Oreille</u> | Moose<br>(2-185)                        | 16.5             | 1987            | 1,00              | 61                           | Brown trout                                   | Test control on stunted<br>brook trout.       |
|                     |   |                  | 1988            | 4,515             | 274                          | Brown trout                                   |   |
|                     |   |                  | 1990            | 500               | 30                           | Brown trout (size 3)                          |   |
|                     |   |                  | 1992            | 500               | 30                           | Brown trout (size 2)                          |   |
|                     | Antelope<br>(2-190)                     | 16               | 1981            | 5,000             | 312                          | westslope cutthroat                           |   |
|                     |   |                  | 1982            | 5,032             | 314                          | westslope cutthroat                           |   |
|                     |   |                  | 1989            | 200               | 12                           | Shepard of the Hills rainbow (size 3)         |   |
|                     |   |                  | 1989            | 1,155             | 72                           | Mt. Lassen rainbow (size 3)                   |   |
|                     |   |                  | 1990            | 1,000             | 63                           | Catchable rainbow                             |   |
|                     |   |                  | 1990            | 200               | 12                           | westslope cutthroat broodstock                |   |
|                     |   |                  | 1991            | 2,000             | 125                          | westslope cutthroat (size 2)                  |   |
|                     |   |                  | 1991            | 1,100             | 69                           | Eagle Lake rainbow (size 3)                   |   |
|                     |   |                  | 1991            | 50                | 3                            | Creston broodstock rainbow (Eagle Lake stock) |   |
|                     |   |                  | 1992            | 863               | 54                           | Hayspur rainbow (size 3)                      |   |
|                     | Caribou<br>(near Keokee Mtn)<br>(2-196) | 6.8              | 1983            | 2,872             | 422                          | Henrys Lake cutthroat                         |   |
|                     |   |                  | 1984            | 1,750             | 257                          | westslope cutthroat                           |   |
|                     |   |                  | 1985            | 1,700             | 250                          | westslope cutthroat                           |   |
|                     |   |                  | 1986            | 1,500             | 220                          | westslope cutthroat                           |   |
|                     |   |                  | 1987            | 1,704             | 250                          | westslope cutthroat                           |   |
|                     |   |                  | 1988            | 1,722             | 253                          | westslope cutthroat                           |   |
|                     |   |                  | 1989            | 1,700             | 250                          | westslope cutthroat                           |   |
|                     |   |                  | 1990            | 1,700             | 250                          | westslope cutthroat                           |   |
|                     |   |                  | 1991            | 1,700             | 250                          | westslope cutthroat                           |   |
|                     |   |                  | 1992            | 1,750             | 257                          | westslope cutthroat                           |   |
| <u>Spokane</u>      | Mirror<br>(3-117)                       | 5                | 1981            | 5,000             | 1,000                        | westslope cutthroat                           | winter kill lake,<br>before further stocking. |
|                     |   |                  |                 |                   |                              |   |   |
|                     | Elsie<br>(3-119)                        | 10               | 1982            | 1,440             | 144                          | Catchable rainbow                             | Stock put-and-take<br>(catchable) rainbow     |
|                     |   |                  | 1983            | 1,500             | 150                          | Catchable rainbow                             |   |
|                     |   |                  | 1984            | 2,865             | 286                          | Catchable rainbow                             |   |
|                     |   |                  | 1985            | 3,005             | 300                          | Catchable rainbow                             |   |
|                     |   |                  | 1986            | 3,024             | 302                          | Catchable rainbow                             |   |
|                     |   |                  | 1987            | 2,000             | 200                          | Hayspur rainbow (size 3)                      |   |
|                     |   |                  | 1988            | 4,050             | 405                          | Hayspur rainbow (size 3)                      |   |
|                     |   |                  | 1989            | 2,856             | 284                          | Mt. Lassen rainbow (size 3)                   |   |
|                     |   |                  | 1990            | 3,000             | 300                          | Catchable rainbow                             |   |
|                     |   |                  | 1991            | 3,516             | 350                          | Eagle Lake and Hayspur rainbow (size 3)       |   |
|                     |   |                  | 1992            | 4,020             | 402                          | Hayspur rainbow (size 3)                      |   |



Table 1. Continued.

| Drainage | Lake                     | Surface<br>acres | Year<br>stocked | Number<br>stocked | Stocking rate<br>(fish/acre) | Stock of fish               | Comments   |
|----------|--------------------------|------------------|-----------------|-------------------|------------------------------|-----------------------------|--|
| Spokane  | Lower Glidden<br>(3-123) | 12               | 1981            | 1,950             | 162                          | Catchable rainbow           |  |
|          |                          |                  | 1982            | 1,880             | 157                          | Catchable rainbow           |  |
|          |                          |                  | 1983            | 1,000             | 83                           | Catchable rainbow           |  |
|          |                          |                  | 1984            | 4,945             | 412                          | Catchable rainbow           |  |
|          |                          |                  | 1985            | 3,018             | 251                          | Catchable rainbow           |  |
|          |                          |                  | 1986            | 3,011             | 251                          | Catchable rainbow           |  |
|          |                          |                  | 1987            | 3,277             | 273                          | Hayspur rainbow (size 3)    |  |
|          |                          |                  | 1988            | 3,001             | 250                          | Hayspur rainbow (size 3)    |  |
|          |                          |                  | 1989            | 2,836             | 236                          | Mt. Lassen rainbow (size 3) |  |
|          |                          |                  | 1990            | 1,775             | 148                          | Catchable rainbow           |  |
|          |                          |                  | 1991            | 1,986             | 165                          | Hayspur rainbow (size 3)    |  |
|          |                          |                  | 1992            | 3,534             | 295                          | Hayspur rainbow (size 3)    |  |
|          | Upper Glidden<br>(3-124) | 10               | 1980            | 992               | 99                           | Kamloops rainbow            | Evaluate Kamloops control<br>of stunted brook trout. |
|          |                          |                  |                 |                   |                              |                             |  |
|          | Gold<br>(3-125)          | 3                | 1981            | 1,000             | 333                          | Westslope cutthroat         | Shallow, need to evaluate<br>for survival.           |
|          |                          |                  | 1983            | 1,005             | 335                          | Henry's Lake cutthroat      |  |
|          |                          |                  | 1987            | 750               | 250                          | Westslope cutthroat         |  |
|          |                          |                  | 1989            | 750               | 250                          | Westslope cutthroat         |  |
|          |                          |                  | 1991            | 750               | 250                          | Mt. Lassen rainbow          |  |
|          | Revett                   | 12               | 1980            | 992               | 83                           | Kamloops rainbow            | Evaluate Kamloops control<br>of stunted brook trout. |
|          |                          |                  |                 |                   |                              |                             |  |
|          | Crater<br>(3-133)        | 5                | 1983            | 5,000             | 1,000                        | Grayling                    | Reserve for grayling.                                |
|          |                          |                  | 1987            | 2,100             | 420                          | Grayling                    |  |
|          |                          |                  | 1988            | 2,500             | 500                          | Grayling                    |  |
|          |                          |                  | 1990            | 2,500             | 500                          | Grayling                    |  |
|          |                          |                  | 1991            | 2,500             | 500                          | Grayling                    |  |
|          | Dismal<br>(3-138)        |                  | 1983            | 1,500             |                              | Catchable rainbow           | Reduce stocking to 250 fish<br>and evaluate.         |
|          |                          |                  | 1984            | 537               |                              | Catchable rainbow           |  |
|          |                          |                  | 1985            | 490               |                              | Catchable rainbow           |  |
|          |                          |                  | 1986            | 253               |                              | Catchable rainbow           |  |
|          |                          |                  | 1987            | 249               |                              | Hayspur rainbow (size 3)    |  |
|          |                          |                  | 1988            | 260               |                              | Mt. Lassen rainbow (size 3) |  |
|          |                          |                  | 1988            | 260               |                              | Hayspur rainbow (size 3)    |  |
|          |                          |                  | 1989            | 225               |                              | Mt. Lassen rainbow (size 3) |  |
|          |                          |                  | 1990            | 250               |                              | Catchable rainbow           |  |
|          |                          |                  | 1991            | 243               |                              | Hayspur rainbow (size 3)    |  |
|          |                          |                  | 1992            | 250               |                              | Hayspur rainbow (size 3)    |  |

Table 1. Continued.

| Drainage                                     | Lake                   | Surface<br>acres | Year<br>stocked | Number<br>stocked | Stocking rate<br>(fish/acre) | Stock of fish         | Comments                            |
|--|------------------------|------------------|-----------------|-------------------|------------------------------|-----------------------|-------------------------------------|
| <u>Spokane</u>                               | Bacon<br>(3-144)       | 9                | 1981            | 4,000             | 444                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1985            | 2,255             | 250                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1987            | 2,250             | 250                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1989            | 2,250             | 250                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1991            | 2,250             | 250                          | Westslope cutthroat   |                                     |
|  | Forage<br>(3-146)      | 13               | 1987            | 3,150             | 242                          | Golden trout          | Reserve for goldens or<br>grayling. |
|  |                        |                  | 1988            | 3,250             | 250                          | Grayling              |                                     |
|  |                        |                  | 1989            | 2,000             | 154                          | Grayling              |                                     |
|  |                        |                  | 1990            | 3,250             | 250                          | Goldent trout         |                                     |
|  |                        |                  | 1992            | 600               | 46                           | Grayling              |                                     |
|  | Halo<br>(3-147)        | 12               | 1981            | 5,000             | 417                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1985            | 3,010             | 251                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1987            | 3,000             | 250                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1989            | 3,000             | 250                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1991            | 3,000             | 250                          | Westslope cutthroat   |                                     |
|  | Crystal<br>(3-160)     | 10               | 1981            | 9,988             | 999                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1983            | 4,380             | 438                          | Henrys Lake cutthroat |                                     |
|  |                        |                  | 1985            | 2,510             | 251                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1987            | 2,510             | 251                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1988            | 2,500             | 250                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1989            | 2,500             | 250                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1991            | 2,500             | 250                          | Westslope cutthroat   |                                     |
| <u>Little Nork</u><br><u>Fork Clearwater</u> | Devils Club<br>(6-113) | 4                | 1981            | 3,014             | 753                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1986            | 1,000             | 250                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1988            | 1,000             | 250                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1990            | 1,093             | 273                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1991            | 1,093             | 273                          | Westslope cutthroat   |                                     |
|  |                        |                  | 1992            | 1,000             | 250                          | Westslope cutthroat   |                                     |
|  | Big Talk<br>(6-114)    | ?                | 1986            | 1,500             |                              | Westslope cutthroat   |                                     |
|  |                        |                  | 1988            | 2,500             |                              | Westslope cutthroat   |                                     |
|  |                        |                  | 1990            | 2,737             |                              | Westslope cutthroat   |                                     |
|  |                        |                  | 1992            | 2,500             |                              | Westslope cutthroat   |                                     |

Table 1. Continued.

| Drainage               | Lake                  | Surface<br>acres | Year<br>stocked | Number<br>stocked | Stocking rate<br>(fish/acre) | Stock of fish       | Comments |
|------------------------|-----------------------|------------------|-----------------|-------------------|------------------------------|---------------------|----------|
| <u>Little Work</u>     |                       |                  |                 |                   |                              |                     |          |
| <u>Fork Clearwater</u> | Larkins<br>(6-117)    | 12               | 1981            | 3,014             | 251                          | westslope cutthroat |          |
|                        |                       |                  | 1986            | 3,000             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1988            | 3,000             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1990            | 3,278             | 273                          | westslope cutthroat |          |
|                        | Mud<br>(6-118)        | 6                | 1981            | 3,014             | 502                          | westslope cutthroat |          |
|                        |                       |                  | 1987            | 1,500             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1989            | 1,500             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1991            | 1,500             | 250                          | Mt. Lassen rainbow  |          |
|                        | Hero<br>(6-119)       | 4                | 1981            | 3,014             | 753                          | westslope cutthroat |          |
|                        |                       |                  | 1986            | 1,000             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1988            | 1,000             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1990            | 1,000             | 273                          | westslope cutthroat |          |
|                        |                       |                  | 1992            | 1,000             | 250                          | westslope cutthroat |          |
|                        | Heart<br>(6-122)      | 40               | 1981            | 3,014             | 75                           | westslope cutthroat |          |
|                        |                       |                  | 1986            | 10,000            | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1990            | 10,000            | 250                          | Mt. Lassen rainbow  |          |
|                        |                       |                  | 1992            | 10,000            | 250                          | Mt. Lassen rainbow  |          |
|                        | Northbound<br>(6-123) | 12               | 1981            | 3,014             | 251                          | westslope cutthroat |          |
|                        |                       |                  | 1986            | 3,000             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1988            | 3,000             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1990            | 3,278             | 273                          | westslope cutthroat |          |
|                        |                       |                  | 1992            | 3,000             | 250                          | westslope cutthroat |          |
|                        | Skyland<br>(6-125)    | 13               | 1981            | 3,014             | 232                          | westslope cutthroat |          |
|                        |                       |                  | 1987            | 3,250             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1989            | 3,250             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1991            | 3,250             | 250                          | Mt. Lassen rainbow  |          |
|                        | Fawn<br>(6-126)       | 13               | 1981            | 3,014             | 232                          | westslope cutthroat |          |
|                        |                       |                  | 1986            | 3,250             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1988            | 3,250             | 250                          | westslope cutthroat |          |
|                        |                       |                  | 1990            | 3,565             | 274                          | westslope cutthroat |          |
|                        |                       |                  | 1992            | 3,250             | 250                          | westslope cutthroat |          |

Table 1. Continued.

| Drainage               | Lake                 | Surface<br>acres | Year<br>stocked | Number<br>stocked | Stocking rate<br>(fish/acre) | Stock of fish            | Comments              |
|------------------------|----------------------|------------------|-----------------|-------------------|------------------------------|--------------------------|-----------------------|
| <u>Little Nork</u>     |                      |                  |                 |                   |                              |                          |                       |
| <u>Fork Clearwater</u> | Noseeum<br>(6-130)   | 4                | 1981            | 1,174             | 294                          | Rainbow/cutthroat hybrid |                       |
|                        |                      |                  | 1985            | 1,008             | 251                          | westslope cutthroat      |                       |
|                        |                      |                  | 1987            | 1,000             | 250                          | westslope cutthroat      |                       |
|                        |                      |                  | 1989            | 1,000             | 250                          | westslope cutthroat      |                       |
|                        |                      |                  | 1991            | 1,000             | 250                          | westslope cutthroat      |                       |
|                        | Steamboat<br>(6-131) | 9                | 1981            | 1,174             | 130                          | Rainbow/cutthroat hybrid | Reserve for grayling. |
|                        |                      |                  | 1986            | 2,000             | 222                          | Grayling                 |                       |
|                        |                      |                  | 1988            | 4,500             | 500                          | Grayling                 |                       |
|                        |                      |                  | 1989            | 2,000             | 222                          | Grayling                 |                       |
|                        |                      |                  | 1990            | 4,500             | 500                          | Grayling                 |                       |
|                        |                      |                  | 1991            | 3,500             | 389                          | Grayling                 |                       |
|                        |                      |                  | 1992            | 650               | 72                           | Grayling                 |                       |
|                        | Copper<br>(6-201)    | 3                | 1981            | 1,000             | 333                          | westslope cutthroat      |                       |
|                        |                      |                  | 1981            | 1,000             | 333                          | Rainbow/cutthroat hybrid |                       |
|                        |                      |                  | 1985            | 765               | 255                          | westslope cutthroat      |                       |
|                        |                      |                  | 1989            | 750               | 250                          | westslope cutthroat      |                       |
|                        |                      |                  | 1991            | 750               | 250                          | westslope cutthroat      |                       |
|                        |                      |                  | 1992            | 1,250             | 417                          | westslope cutthroat      |                       |
|                        | Gold<br>(6-202)      | 8                | 1986            | 2,000             | 250                          | westslope cutthroat      |                       |
|                        |                      |                  | 1988            | 2,000             | 250                          | westslope cutthroat      |                       |
|                        |                      |                  | 1990            | 2,185             | 273                          | westslope cutthroat      |                       |
|                        | Tin<br>(6-204)       | 3                | 1987            | 750               | 250                          | westslope cutthroat      |                       |
|                        |                      |                  | 1988            | 750               | 250                          | westslope cutthroat      |                       |
|                        |                      |                  | 1990            | 750               | 250                          | Blackfoot rainbow        |                       |
|                        |                      |                  | 1992            | 750               | 250                          | Mt. Lassen rainbow       |                       |
|                        | Silver<br>(6-205)    | 10               | 1981            | 200               | 200                          | westslope cutthroat      |                       |
|                        |                      |                  | 1981            | 888               | 89                           | Rainbow                  |                       |
|                        |                      |                  | 1985            | 999               | 100                          | Mt. Lassen rainbow       |                       |
|                        |                      |                  | 1989            | 2,500             | 250                          | westslope cutthroat      |                       |
|                        |                      |                  | 1991            | 2,500             | 250                          | westslope cutthroat      |                       |

Table 2. Odd year stocking schedule for Region 1 mountain lakes.

| Lake                          | Code No. | Surface<br>acres | No.<br>stocked | Species   | Substitute<br>species |
|-------------------------------|----------|------------------|----------------|-----------|-----------------------|
| <u>Kootenai</u>               |          |                  |                |           |                       |
| Hidden                        | 01-103   | 50               | 12,500         | C2        | K1                    |
| Lake Mtn.                     | 01-104   | 7                | 1,750          | C2        | None                  |
| West Fork                     | 01-109   | 12               | 3,000          | K1        | C2                    |
| Long Mtn.                     | 01-112   | 3                | 1,500          | GR        | None                  |
| Parker                        | 01-113   | 3                | 1,000          | GN        | GR                    |
| Smith                         | 01-115   | 6                | 3,000          | GR        | None                  |
| Myrtle                        | 01-122   | 20               | 5,000          | C2        | None                  |
| Pyramid                       | 01-125   | 11               | 2,750          | K1        | C2                    |
| Snow                          | 01-134   | 10               | 2,500          | C2        | None                  |
| Roman Nose #3                 | 01-137   | 12               | 3,000          | K1        | C2                    |
| Solomon                       | 01-146   | 9                | 2,250          | C2        | K1                    |
| Spruce                        | 01-147   | 5                | 1,250          | K1        | C2                    |
| Debt                          | 01-150   | 5                | 1,250          | C2        | None                  |
| Callahan                      | 01-166   | 10               | 2,500          | C2        | None                  |
| <u>Pend Oreille</u>           |          |                  |                |           |                       |
| Hunt                          | 02-101   | 12               | 3,000          | C2        | None                  |
| Standard                      | 02-103   | 16               | 4,000          | C2        | None                  |
| Two Mouth #2                  | 02-107   | 5                | 1,250          | C2        | None                  |
| Mollies                       | 02-114   | 2                | 500            | C2        | None                  |
| Fault                         | 02-121   | 6                | 1,500          | C2        | None                  |
| McCormick                     | 02-122   | 3.1              | 775            | C2        | None                  |
| Beehive                       | 02-128   | 7                | 1,750          | C2        | None                  |
| Harrison                      | 02-129   | 29               | 7,250          | C2        | None                  |
| Dennick                       | 02-171   | 8                | 2,000          | C2        | None                  |
| Sand                          | 02-172   | 5                | 1,250          | C2        | None                  |
| Bloom                         | 02-173   | 20               | *5,000         | BK*Size 2 | None                  |
| Caribou (near<br>Keokee Mtn.) | 02-196   | 6.8              | 1,700          | C2        | None                  |

Table 2. Continued.

| Lake                                | Code   | Surface<br>acres | No.<br>stocked | Species | Substitute<br>species |
|-------------------------------------|--------|------------------|----------------|---------|-----------------------|
| Spokane                             |        |                  |                |         |                       |
| Gold                                | 03-125 | 3                | 750            | K1      | None                  |
| Crater                              | 03-133 | 5                | 2,500          | GR      | None                  |
| Bacon                               | 03-144 | 9                | 2,250          | C2      | None                  |
| Forage                              | 03-146 | 13               | 3,250          | GN      | GR                    |
| Halo                                | 03-147 | 12               | 3,000          | C2      | None                  |
| Crystal                             | 03-160 | 10               | 2,500          | C2      | None                  |
| <u>Little North Fork Clearwater</u> |        |                  |                |         |                       |
| Mud                                 | 06-118 | 6                | 1,500          | K1      | None                  |
| Skyland                             | 06-125 | 13               | 3,250          | K1      | None                  |
| No Seeum                            | 06-130 | 4                | 1,000          | C2      | None                  |
| Steamboat                           | 06-131 | 9                | 4,500          | GR      | None                  |
| Copper                              | 06-201 | 3                | 750            | C2      | None                  |
| Silver                              | 06-205 | 10               | 2,500          | K1      | None                  |

Total number of fish to be stocked:

C2 - 62,225

K1 - 18,000

GR - 11,500

GN - 4,250 (grayling can be substituted for goldens)

BK - 5,00 Size 2

Table 3. Even year stocking schedule for Region 1 mountain

| Lake                             | Code No. | Surface<br>acres | No.<br>stocked | Species    | Substitute<br>species |
|----------------------------------|----------|------------------|----------------|------------|-----------------------|
| <u>Kootenai</u>                  |          |                  |                |            |                       |
| Hidden                           | 01-103   | 50               | 12,500         | K1         | C2                    |
| West Fork                        | 01-109   | 12               | 3,000          | C2         | K1                    |
| Long Mtn.                        | 01-112   | 3                | 1,500          | GR         | None                  |
| Parker                           | 01-113   | 3                | 1,000          | GN         | GR                    |
| Smith                            | 01-115   | 6                | 3,000          | GR         | None                  |
| Big Fisher                       | 01-117   | 10               | 2,500          | C2         | None                  |
| Trout                            | 01-124   | 7                | 1,750          | K1         | C2                    |
| Pyramid                          | 01-125   | 11               | 2,750          | C2         | K1                    |
| Ball Creek                       | 01-126   | 6                | 1,500          | C2         | None                  |
| Little Ball Creek                | 01-127   | 4                | 1,000          | C2         | None                  |
| Roman Nose #3                    | 01-137   | 12               | 3,000          | C2         | K1                    |
| Solomon                          | 01-146   | 9                | 2,250          | C2         | K1                    |
| Spruce                           | 01-147   | 5                | 1,250          | C2         | K1                    |
| Queen                            | 01-148   | 5                | 1,250          | C2         | None                  |
| Copper                           | 01-154   | 5                | 1,250          | C2         | None                  |
| Estelle                          | 01-167   | 5                | 1,250          | BN         | None                  |
| <u>Pend Oreille</u>              |          |                  |                |            |                       |
| Hunt                             | 02-101   | 12               | 3,000          | C2         | None                  |
| Two Mouth #3                     | 02-108   | 20               | 5,000          | C2         | None                  |
| Caribou (near<br>West Fork Mtn.) | 02-116   | 6.8              | 1,750          | C2         | None                  |
| Little Harrison                  | 02-126   | 6.5              | 1,625          | C2         | None                  |
| Harrison                         | 02-129   | 29               | 7,250          | C2         | None                  |
| Beaver                           | 02-130   | 5                | 1,250          | BN         | None                  |
| Dennick                          | 02-171   | 8                | 2,000          | C2         | None                  |
| Sand                             | 02-172   | 5                | 1,250          | C2         | None                  |
| Bloom                            | 02-173   | 20               | *5,000         | BK *Size 2 | None                  |
| Moose                            | 02-185   | 16.5             | 4,200          | BN         | None                  |
| Caribou (near<br>Keokee Mtn.)    | 02-196   | 6.8              | 1,700          | C2         | None                  |

Table 3. Continued.

| Lake                         | Surface<br>Code No. | No.<br>stocked | Species | Substitute<br>species |      |
|------------------------------|---------------------|----------------|---------|-----------------------|------|
| Spokane                      |                     |                |         |                       |      |
| Crater                       | 03-133              | 5              | 2,500   | GR                    | None |
| Forage                       | 03-146              | 13             | 3,250   | GN                    | GR   |
| Little North Fork Clearwater |                     |                |         |                       |      |
| Devils Club                  | 06-113              | 4              | 1,000   | C2                    | None |
| Big Talk                     | 06-114              | ?              | 2,500   | C2                    | None |
| Larkins                      |                     | 12             | 3,000   | C2                    | None |
| Hero                         | 06-117              | 4              | 1,000   | C2                    | None |
| Heart                        | 06-122              | 40             | 10,000  | K1                    | None |
| Northbound                   |                     | 12             | 3,000   | C2                    | None |
| Fawn                         | 06-126              | 13             | 3,250   | C2                    | None |
| Steamboat                    |                     | 9              | 4,500   | GR                    | None |
| Gol                          | 06-202              | 8              | 2,000   | C2                    | None |
| Tin                          | 06-204              | 3              | 750     | Ki                    | None |

Total number of fish to be stocked:

C2 - 59,075

K1 - 25,000

GR - 11,500

GN - 4,250 (grayling can be substituted for goldens)

BK - 5,000 Size 2

BN - 6,700



Table 4. Summary of physical measurements taken at Revett and Upper Glidden lakes, Idaho, 1991.

|                          | Revett  | Upper Glidden |
|--------------------------|---------|---------------|
| Survey date              | 8-21-91 | 7-11-91       |
| Surface area (ha)        | 4.5     | 4.5           |
| Maximum depth (m)        | 11      | 12            |
| Surface temperature (°C) | 17.9    | 12.7          |
| Secchi transparency (m)  | 9.0     | 13.1          |
| Conductivity (umhos)     | 50      | -             |
| pH                       | 3.1     | -             |

predator fish at stocking is one of the main factors controlling success. Fish predators must be large enough to begin feeding immediately on the stunted prey, otherwise predators will be caught in the same food trap that originally caused the stunting in the prey.

Emigration from the lake must be considered when introducing a new species to the drainage. If the predator species has the potential to negatively alter downstream fish populations and fisheries, it should not be stocked. A predator with a short life span allows the fishery manager the ability to change management strategy by waiting until the predator 'dies out.' For example, chinook live 3 to 4 years, and lake trout live 20 years or more. Bull trout would be best suited as a predator in South Fork Coeur d'Alene River drainage mountain lakes because it is short lived, 8 years, and it is native to the drainage so emigration would not be a problem.

The last and most effective method is reclamation; poisoning all of the brook trout and starting over. This method achieves the best results, but is the most expensive. However, a Washington State researcher estimated a \$32.00 to \$105.00 gain in fishing expenditures for every dollar spent on rotenone (Sousa et al.). Stocking a new species after removing brook trout prevents competition between the species. Growth of the new species is good for the first few years and can remain high by controlling the population density through stocking.

A number of factors determine which of the above methods is used; management priority, available manpower, and available money. The overriding factor is the fishing public. Do they want a change?

Three public meetings were held to assess public fishing preferences. Thirty-one people attended the meetings. All the people that attended these meetings supported the plan to stock bull trout into three of the lakes; Upper Glidden, Upper Stevens, and Revett. They also agreed with a suggestion, that was made during the first meeting, to investigate the possibility of increasing the daily bag limit for brook trout at Lower Glidden and Lower Elsie lakes as a method to reduce brook trout abundance.

### **RECOMMENDATIONS**

1. Develop a mountain lake management plan that addresses management objectives, standardized survey techniques, and evaluation procedures for both short- and long-term goals.
2. Follow recommendations in Tables 2 and 3 regarding even or odd year stocking. Stock lakes that have been missed for several years and temporarily discontinue stocking lakes where stunted fish populations are known to exist.
3. Obtain late egg takes (spring spawning) from domestic Kamloops rainbow trout so that the proper size fry are available for mountain lake stocking. If this is not possible, switch rainbow stocking to a different stock of fish and evaluate their success.
4. Continue species diversity program by utilizing westslope cutthroat and Kamloops rainbow trout. Obtain grayling and golden trout so unique mountain lake fisheries can become a reality.
5. Utilize voluntary angler reports to assess fish populations and angler satisfaction. Utilize existing angler diary report forms to obtain this data.

SEC1-A

6. Work with the Forest Service and Boundary County Backpackers to create a trail into Smith Lake to provide improved angling opportunity for grayling.
7. Consider stocking grayling or golden into a more accessible lake to provide increased angling opportunity for specialty stocks. Consult Department personnel and interested anglers to determine suitable waters. Survey lakes and consider a restoration project to eliminate competition from non-specialty stocks.
8. Determine condition factor of brook trout in Upper and Lower Glidden, Lower Elsie, Upper Stevens, and Revett lakes.
9. Determine harvest of brook trout in Lower Glidden and Lower Elsie lakes to evaluate the possibility of increasing the bag limit on brook trout to reduce the population.
10. Stock Upper Glidden, Upper Stevens, and Revett lakes with bull trout in 1993.
11. Evaluate the effectiveness of brown trout, bull trout, and splake Salvelinus fontinalis x S. namaycush in controlling stunting in brook trout populations.

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Sousa, R.J., F.P. Meyer and R.A. Schnick. not dated. Better fishing through management. How rotenone is used to help manage our fishery resources more effectively. U.S. Fish and Wildlife Service (Pamphlet).

## JOB PERFORMANCE REPORT

State of: Idaho Name: Regional Fishery Management  
Investigations

Project No.: F-71-R-16 Title: Region 1 Lowland Lakes  
Investigations

Job No.: 1-b<sup>1</sup>

Period Covered: July 1, 1991 to June 30, 1992

### ABSTRACT

In Priest Lake, 81 lake trout Salvelinus namaycush were tagged during May 1991 with \$5 reward Floy tags. A total of 223 lake trout have been reward-tagged in Priest Lake since 1989, and 14 tags have been returned. Exploitation of tagged lake trout in Priest Lake was 6.3%.

Bull trout Salvelinus confluentus redds were counted in five tributaries to Lake Pend Oreille in 1991. An estimated 1,739 bull trout entered these five tributaries in 1991 to spawn based on a 3.9 fish/redd expansion factor (Pratt 1984). This is an increase of 6.7% over 1990 escapement.

A total of 34,870 westslope cutthroat trout Oncorhynchus clarki lewisi were reared in five net pens on Lake Pend Oreille and released in 1991. An additional 87,491 westslope cutthroat trout, raised at Clark Fork Hatchery, were stocked into the lake. Two hundred twenty-five of the net pen fish received \$5 reward Floy tags. Exploitation of the net pen cutthroat trout was estimated at 1.3%.

In June and July 1991, 34 largemouth bass Micropterus salmoides and 5 smallmouth bass Micropterus dolomieu were collected from Hayden Lake and tagged with \$5 reward Floy tags. Two of the largemouth bass tags were returned in 1991 for a return rate of 5.9%. No smallmouth bass tags were returned.

Mirror Lake was rotenoned on October 8, 1991 to remove an unwanted population of black crappie Pomoxis nigromaculatus. The density of black crappie in the 98.5-acre lake was estimated at 58.9 pounds per acre. Other species present in Mirror Lake included brown trout Salmo trutta, westslope cutthroat trout, brook trout Salvelinus fontinalis, and kokanee salmon Oncorhynchus nerka kennerlyi. The only natural reproduction noted to have taken place, other than the crappie, was that of the kokanee salmon. Mirror Lake will be restocked with salmonids in 1992 and managed as a salmonid only consumptive fishery.

In Spirit Lake, the 1991 kokanee population was estimated to be 703.4 thousand fish. Age 3 kokanee abundance was the lowest ever recorded, 19.2 thousand. All kokanee under 220 mm in length were immature and all kokanee over 220 mm in length were mature.

A creel survey was conducted to estimate the harvest of northern pike Esox lucius from Cougar Bay, Coeur d'Alene Lake, Idaho in 1991. Anglers expended an estimated 14,685 (+/-2683 @ 95t C.I.) during the four-week period. An estimated total of 832 (+/- 546 @ 95t C.I.) northern pike were caught. Harvest of northern pike was estimated to be 672 fish (+/- 349 @ 95t C.I.). The catch rate was 0.057 fish/h or 17.7 hrs/fish. Mean length of northern pike harvested was 591 mm (range 356-813 mm, N=30).

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## OBJECTIVES

1. To assess the exploitation of lake trout Salvelinus namaycush in Priest Lake.
2. To assess the status of the bull trout S. confluentus population in Lake Pend Oreille based on abundance of redds in selected tributaries of Lake Pend Oreille.
3. To assess the contribution of net pen raised westslope cutthroat trout Oncorhynchus clarki lewisi to the Lake Pend Oreille fishery.
4. To determine the exploitation of largemouth bass Micropterus salmoides, smallmouth bass M. dolomieu, and black crappie Pomoxis nigromaculatus in Hayden Lake.
5. To evaluate the age and growth of largemouth bass, smallmouth bass, and black crappie in Hayden Lake.
6. To eliminate an undesirable population of black crappie in Mirror Lake and restock with salmonid species.
7. Monitor kokanee O. nerka kennerlyi population status by mid-water trawling to determine the relationship between kokanee abundance and the resulting fishery in Spirit Lake.
8. Estimate angler pressure and harvest of northern pike Esox lucius in Cougar Bay in Coeur d'Alene Lake, Idaho during the spring fishery.

## PRIEST LAKE

### Introduction

Priest Lake (9,450 ha) has undergone dramatic changes in species composition since the early 1900s. Bull trout and cutthroat trout are the only native sport fish in the lake. By the 1950s, cutthroat trout abundance had been greatly reduced, and most of the sport fishery was for kokanee salmon that were introduced in the 1940s (Bjornn 1957). The introduction of Mysis shrimp in 1965 enhanced the lake trout population by increasing juvenile survival. Eight years of kokanee stocking were not successful in restoring kokanee, and they currently exist in the upper lake in low abundance. Between 1989 and 1991, over 235,000 fingerling cutthroat trout were stocked in Priest Lake in an attempt to reestablish a limited consumptive cutthroat trout fishery. This program was discontinued in 1992 due to virtually no return to the creel of these fish. Management direction for Priest Lake changed in 1992 to reflect the existing fish species composition and inability to reestablish kokanee salmon and cutthroat trout fisheries by stocking. Regulations were changed on lake trout to increase the harvest of smaller fish while allowing some fish to escape into the slot limit and grow to trophy size. From the previous two fish any size regulation, the new regulations allows the harvest of three lake trout, none between 26 inches and 32 inches, and only one over 32 inches.

### Lake Trout

#### Methods

A lake trout tagging program, using \$5 reward Floy tags, was started in 1990 to assess exploitation. From 1977 to 1987, volunteer anglers tagged lake trout with jaw tags and released them in an attempt to gain growth, movement, and

exploitation information but due to poor data collection and reporting, this program was discontinued.

On May 21, 1991, 81 lake trout were captured utilizing gill net and hook and line methods and tagged with \$5 reward Floy tags (series A-501 to A-600 white and 2102 to 2122 yellow). The gillnetting efforts resulted in the death of ten lake trout, even though the nets were set for less than one hour. Netting locations were near Bartoo Island, Pinto Point, Eight Mile Island, and West Twin Island.

## **Results and Discussion**

In 1991, 11 reward tags were returned; 5 of these tags were from the 1990 tagging efforts (96 lake trout tagged) and 6 from the 1991 efforts. Exploitation of tagged lake trout in Priest Lake is estimated at 7.9% from the 1990 (three tags returned) and 1991 returns. The reward tag program for Priest Lake lake trout was discontinued in 1992 due to the difficulty of capturing sufficient numbers of lake trout to derive a statistically sound estimate of exploitation. It is, however, imperative that the lake trout population be monitored with respect to the new regulations now in effect; three fish, none between 26 inches and 32 inches, and only one over 32 inches. In an effort to assess the effect of the slot limit on the length frequency of lake trout, a volunteer effort will be requested of local fishing guides and other frequent lake trout anglers on Priest Lake to record length information on all fish caught and kept as well as those released. This information can be compared to past data to determine if there is a shift in the length frequency of the lake trout. It will be necessary to maintain constant contact with the volunteers to assure that reliable and accurate data is collected and reported.

With the slot limit on lake trout in Priest Lake there will be frequent releases of fish that were caught in deep water. As these fish are brought to the surface, the change in pressure often causes their air bladder to bloat, making it difficult for the fish to resubmerge. One method used to assist in the resubmersion of the fish is to puncture the air bladder. Although puncturing the air bladder allows the fish to resubmerge, overall survival is not known. During the 1990 and 1991 tagging efforts, a number of the tagged fish were punctured. One of the fish tagged in 1990 which had it's air bladder punctured was caught later in the same year. In a study completed by Michigan State University in 1985, unpublished information indicated that lake trout angled from depths reaching 140 feet were observed resting on the surface for up to 20 minutes before diving below the surface. After 48 hours, these same fish were observed alive. With this information, it is questionable if puncturing the air bladder is necessary for high survival rates in released lake trout.

## **LAKE PEND OREILLE**

### **Introduction**

Lake Pend Oreille (38,300 ha) is the largest natural lake in Idaho, as well as the deepest (354 m). Another distinction of Lake Pend Oreille is that it supports the most productive bull trout fishery in Idaho and a trophy Kamloop rainbow trout fishery. Tributaries to Lake Pend Oreille have been closed to bull trout harvest for decades. New regulations were instituted on the lake in 1988, and adjusted again in 1992, to manage the bull trout and rainbow trout to provide trophy fisheries while offering consumptive fisheries on other species.

At this time, it is believed the bull trout fishery is stable at best, and there is concern that this unique fishery could be lost. Bull trout populations have been monitored since 1983 utilizing spawning ground counts which give an index of abundance and reflect the condition of stream habitat.



## Methods

Bull trout redd surveys have been conducted on tributaries to Lake Pend Oreille each fall since 1983 and have served as an index of adult abundance (Pratt 1984 and 1985, Hoelscher and Bjornn 1988). Similar methodology was also used by Graham et al. (1980), Fraley et al. (1981), and Shepard et al. (1982). The 1991 surveys were conducted on Trestle Creek (October 17), Johnson Creek (October 18), Gold Creek (October 21), North Gold Creek (October 21), and Grouse Creek (October 29). The Grouse Creek survey, in 1991, encompassed only that portion of the stream from Chute Creek downstream to Grouse Creek Falls because of ice and snow cover in the upper reach. Also, due to the sparsity of redds seen in the lower section of Grouse Creek (Flume Creek to Grouse Creek Falls) in 1991 and previous years, future redd counts will end at Flume Creek. The East Fork of Lightning Creek was not surveyed in 1991 because of early snow in the high country which precluded access to the stream. Survey dates were consistent with the schedule used by Pratt (1985); September 20 to October 26. Redds were defined as an area of exceptionally clean gravel with a tail or mound of loose gravel downstream from a depression. In areas where redds appeared to be superimposed, the number of distinct depressions was counted. Bull trout spawning escapement was estimated by multiplying the number of redds by 3.9 fish/redd, as was used by Pratt (1984, 1985) and Hoelscher and Bjornn (1988) and calculated by Fraley et al. (1981). The entire length of creeks where redds had been reported in the past (Hoelscher and Bjornn 1988) were walked in 1991 with the exception of Grouse Creek.

## Results

A total of 446 redds were counted in five tributaries (Table 1). This number is not comparable to previous years total counts due to the portion of Grouse Creek that was not surveyed and the East Fork of Lightning Creek which was not surveyed. Trestle Creek had the highest number of redds observed (243). This is an 11% increase over the 218 redds counted in 1990. The number of redds observed in Johnson Creek was down 24% from 1990, Gold Creek showed an increase of 24%, and North Gold an increase of 17%. Based on 3.9 fish/redd, an estimated 1,739 adult bull trout entered these tributaries to spawn.

## Discussion

Results from the 1991 creel survey (V. Paragamian, Idaho Department of Fish and Game, personal communication) estimated 1,723 bull trout were harvested from Lake Pend Oreille. The mean length of these fish was 492 mm, with a range of 300 mm to 745 mm and a mean weight of 1.45 kg. Considering the degradation of spawning and rearing habitat in the tributary streams and harvest rates that could adversely effect population levels, it is imperative to closely monitor this fishery. Although the 1991 estimated return of adult bull trout spawning in the four (fully surveyed) streams was greater than the previous eight-year average, this number is somewhat lower than the numbers estimated in the early and mid 1980s. It should also be recognized that the East Fork of Lightning Creek, which historically was a major spawning area, was not surveyed in 1991. As recognized by Maiolie in 1990 (Davis et al., in progress), the major decline in redd numbers has occurred in streams such as the East Fork of Lightning Creek, where channel instability caused by mass land failures, loss of woody debris, and massive bedload movement have impacted the spawning habitat. Harvest restrictions cannot offset continued loss and degradation of tributary spawning and rearing habitat. Better definition of bull trout life history and population dynamics is needed to determine if habitat degradation or overharvest is depressing population abundance.

Table 1. Number of bull trout redds counted per stream in the Pend Oreille Lake drainage, 1983-1991.

| Area/Stream                           | Total redds counted |      |      |      |      |      |      |      |                  |
|---------------------------------------|---------------------|------|------|------|------|------|------|------|------------------|
|                                       | 1983                | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991             |
| CLARK FORK RIVER                      |                     |      |      |      |      |      |      |      |                  |
| Lightning Creek                       | 28                  | 9    | 46   | 14   | 4    |      |      |      |                  |
| Spring Creek                          | 0                   | -    | 0    | -    | -    |      |      |      |                  |
| East Fork                             | 110                 | 24   | 132  | 8    | 59   | 79   | 100  | 29   | <sup>a</sup>     |
| Savage Creek                          | 36                  | 12   | 29   | -    | 0    |      |      |      |                  |
| Char Creek                            | 18                  | 9    | 11   | 0    | 2    |      |      |      |                  |
| Porcupine Creek                       | 37                  | 52   | 32   | 1    | 9    |      |      |      |                  |
| Wellington Creek                      | 21                  | 18   | 15   | 7    | 2    |      |      |      |                  |
| Rattle Creek                          | 51                  | 32   | 21   | 10   | 35   |      |      |      |                  |
| Johnson Creek                         | 13                  | 33   | 23   | 36   | 10   | 4    | 17   | 33   | 25               |
| Twin Creek                            | 7                   | 25   | 5    | 28   | 0    |      |      |      |                  |
| NORTHERN SHORE                        |                     |      |      |      |      |      |      |      |                  |
| Trestle Creek                         | 298                 | 272  | 298  | 147  | 230  | 244  | 217  | 218  | 243              |
| Pack River                            | 34                  | 37   | 49   | 25   | 14   |      |      |      |                  |
| Rapid Lightning Creek                 | -                   | 0    | -    | 0    |      |      |      |      |                  |
| Grouse Creek                          | 2                   | 108  | 55   | 13   | 56   | 24   | 50   | 48   | <sup>b</sup> 33  |
| Hellroaring Creek                     | 0                   | -    | 0    |      |      |      |      |      |                  |
| Jeru Creek                            | 0                   | -    | 0    |      |      |      |      |      |                  |
| EASTERN SHORE                         |                     |      |      |      |      |      |      |      |                  |
| Granite Creek                         | 3                   | 81   | 37   | 37   | 30   |      |      |      |                  |
| Sullivan Springs                      | 9                   | 8    | 14   | -    | 6    |      |      |      |                  |
| North Gold Creek                      | 16                  | 37   | 52   | 8    | 36   | 24   | 37   | 35   | 41               |
| Gold Creek                            | 131                 | 124  | 111  | 78   | 62   | 111  | 122  | 84   | 104              |
| TOTAL OF 6 STREAMS<br>COUNTED IN 1991 | 570                 | 598  | 671  | 290  | 453  | 486  | 543  | 510  | <sup>c</sup> 466 |

1983 and 1984 data reported by Pratt (1985).

1985 and 1986 data reported by Hoelscher and Bjornn (1988).

<sup>a</sup> Not surveyed in 1991 due to early snow fall.

<sup>b</sup> Upper section not surveyed, count is from Chute Creek downstream.

<sup>c</sup> Represents only a partial count due to early snow fall.

It is recommended that additional streams be surveyed in 1992. Revisiting some of the streams originally surveyed in the early 1980s would provide us an update of our index streams. Porcupine Creek, Rattle Creek, Pack River, and Granite Creek would be recommended streams to resurvey.

## **NET PEN CUTTHROAT CULTURE**

### **Introduction**

The cutthroat trout net pen culture program on Lake Pend Oreille began in the fall of 1989 when two pens were placed in Garfield Bay. This program was initiated in an attempt to supplement the declining cutthroat trout fishery in the lake. The program was the product of a cooperative effort supported by the Idaho Department of Fish and Game, Bonner County Fisheries Association, Washington Water Power, Lake Pend Oreille Idaho Club, and Trout Unlimited. Approximately 10,000 westslope cutthroat trout are placed in each net pen in the fall of the year and released the following spring. Survival, growth, and overall health of these fish has been shown to be better than can be achieved in a typical hatchery situation.

### **Methods**

During the fall of 1990 and spring of 1991, six net pens were used to raise 34,870 westslope cutthroat trout. These fish were released on May 31, 1991. The net pens were located at five sites on Lake Pend Oreille; Hudson Bay, Bitterend, Scenic Bay, Red Fir, and Garfield Bay, which had two net pens (Figure 1). The entire release of 34,870 cutthroat trout received an adipose fin clip to identify them in the fishery. In addition to the fin clip, 248 fish received Floy \$5 reward tags (yellow - series 15001 to 15250) which were inserted into the dorsal musculature of the fish (approximately 50 fish from each of the five sites). The net pen floating frames were constructed of 6-inch diameter plastic pipe, 20 feet by 20 feet square. The nets (3/8-inch diameter) were suspended from the frame and were 20 feet deep. The four corners of each net were anchored by a 1-gallon container filled with concrete to keep the net from collapsing on itself. The net and frame were secured to boat docks to prevent them from drifting away. Two automatic feeders are stationed at each net pen, with the exception of the Scenic Bay pen which is hand-fed. Volunteers were responsible for the maintenance of the pens and the feeding of the fish.

### **Results and Discussion**

The net pen cutthroat trout were placed in the net pens in October 1990 and released in May 1991. Mean length of the cutthroat trout in October, when placed in the net pens, was 127 mm. At the time of release, May 31, 1991, the mean length was 171 mm. The growth rate and survival of these fish exceeds that of hatchery raceway-reared fish. In 1989, a comparison of the net pen cutthroat trout versus hatchery-reared fish showed that the net pen fish grew an average of 51 mm during their stay in the net pens, while the hatchery fish grew only 30 mm. Mortality of the hatchery fish was approximately 12 times greater than that of the net pen fish for the same time period as well.

Only three reward tags were returned in 1991, all from the 1991 Hudson Bay release. No tags from the 1990 release were returned in 1991. Exploitation in 1990 was estimated at 0.84%, based on a return of two tags; 1991 exploitation was slightly greater at 1.21%. It is expected that the 1990 release will recruit in greater numbers to the fishery in 1992 and the 1991 release in 1993. Because of the lag time involved in the recruitment of these fish, it will be several years before the net pen project can be fully evaluated.

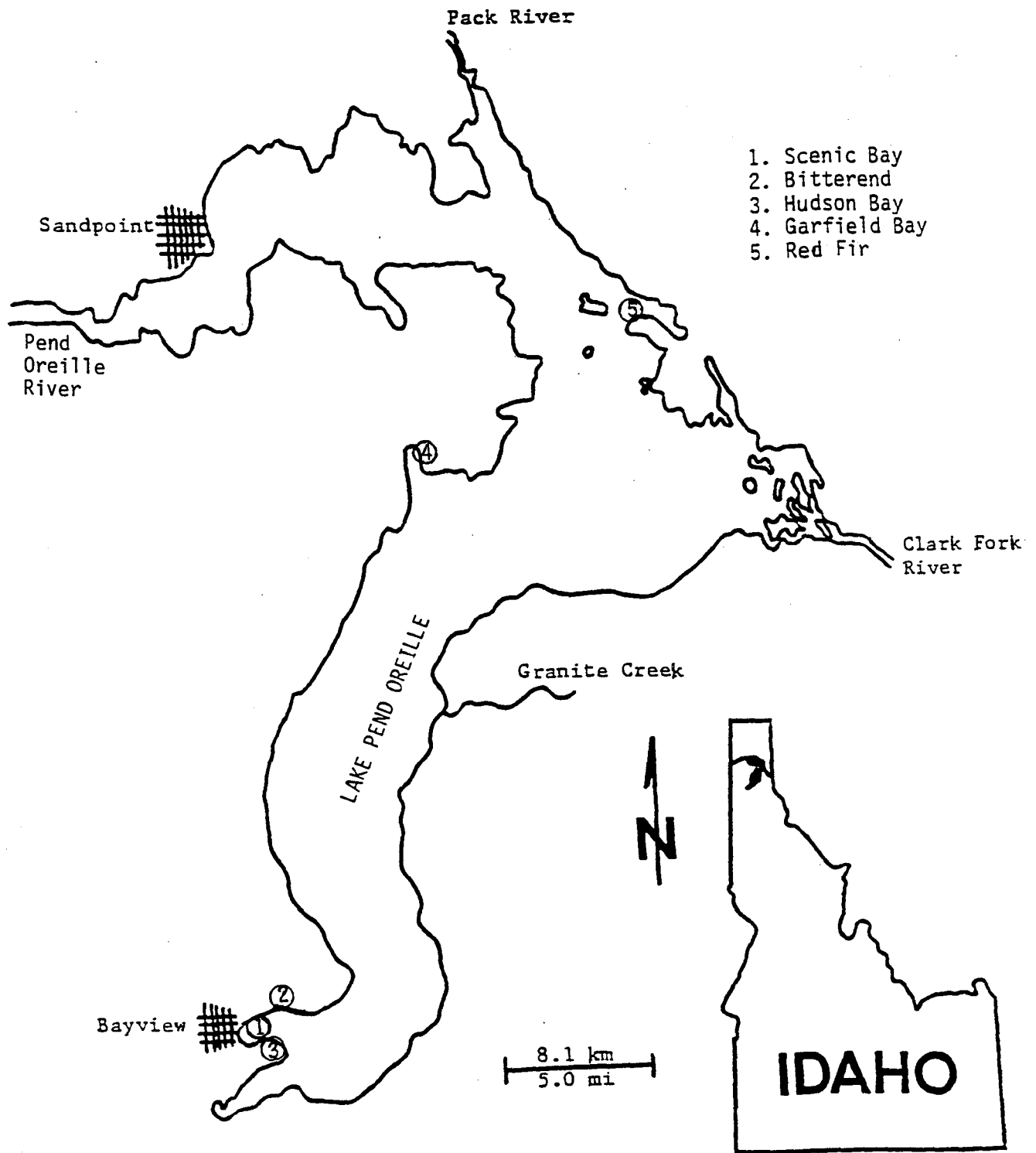


Figure 1. Lake Pend Oreille cutthroat trout net pen locations, 1991.

An additional 87,491 westslope cutthroat trout were stocked in Lake Pend Oreille between April and July 1991 from the Clark Fork Hatchery. The early release in April consisted of 20,993 excess fry with a mean length of 50 mm and were stocked at Sunnyside. In June, a total of 35,106 cutthroat trout with an average length of 152 mm were stocked. June stockings occurred at Ellisport Bay (10,286), Sandpoint Beach boat ramp (11,680), and Bottle Bay Resort (13,140). The July release of 31,392 fish averaged 178 mm in length and were stocked at five locations; Ellisport Bay (4,992 fish), Garfield Bay (10,560), Owens Bay (5,280), Bitterend (5,280), and Farragut State Park boat ramp (5,280).

## **HAYDEN LAKE**

### **Introduction**

Hayden Lake is managed as a quality fishery for trout, bass, and black crappie. Located near major population centers, Hayden Lake has the potential to experience overexploitation of fish stocks even with the restrictive regulations. Tagging studies were initiated in 1989 to evaluate the exploitation of largemouth bass. In 1991, smallmouth bass were added to the tagging study as a portion of that population had recruited to the fishery (smallmouth bass were first introduced into Hayden Lake in 1983). In addition, legal size crappie were also tagged.

### **Methods**

On the nights of June 26 and July 1, 1991, Hayden Lake was electrofished to collect bass and crappie for tagging. Length frequency data and scale samples were also collected. Legal size fish (356 mm for bass and 254 mm for crappie) were tagged with \$5 reward Floy tags.

### **Results**

Electrofishing efforts yielded 113 largemouth bass, 149 smallmouth bass, and 25 black crappie. Of which, 34 largemouth bass, 5 smallmouth bass and 3 black crappie were of legal size (356 mm for bass and 254 mm for crappie). All legal size fish received \$5 reward Floy tags, series A-513 to A-550 (white) and 16201, 16202, 16224, and 16225 (yellow). Largemouth bass in the tagging sample ranged from 355 mm (600 g) to 520 mm (2,200 g) (Figure 2); smallmouth bass ranged from 355 mm (600 g) to 430 mm (1300 g) (Figure 3); and black crappie ranged from 255 mm (250 g) to 265 mm (255 g) (Figure 4). One largemouth bass tagged in 1990 was recaptured in 1991; blue Floy tag #64 was collected July 1 near the mouth of Hayden Creek. This fish measured 510 mm (2,200 g) at recapture; in 1990 when it was tagged it measured 505 mm (2,025 g).

Tag returns from anglers in 1991 accounted for two largemouth bass and one black crappie; all three tags were from the 1991 sampling effort. No smallmouth bass tags were returned. Since 1989, 74 largemouth bass have been tagged, 8 have been harvested (10.8%), and 1 (1.4%) released.

Relative stock densities (RSD) (Gabelhouse 1984) were calculated for largemouth bass (1989 to 1991) and smallmouth bass (1991) from length frequency indices. Because of a change in regulations in 1992 to the statewide quality bass regulation (two bass - none between 12 and 16 inches), RSD's are reported to fit the new size limits.

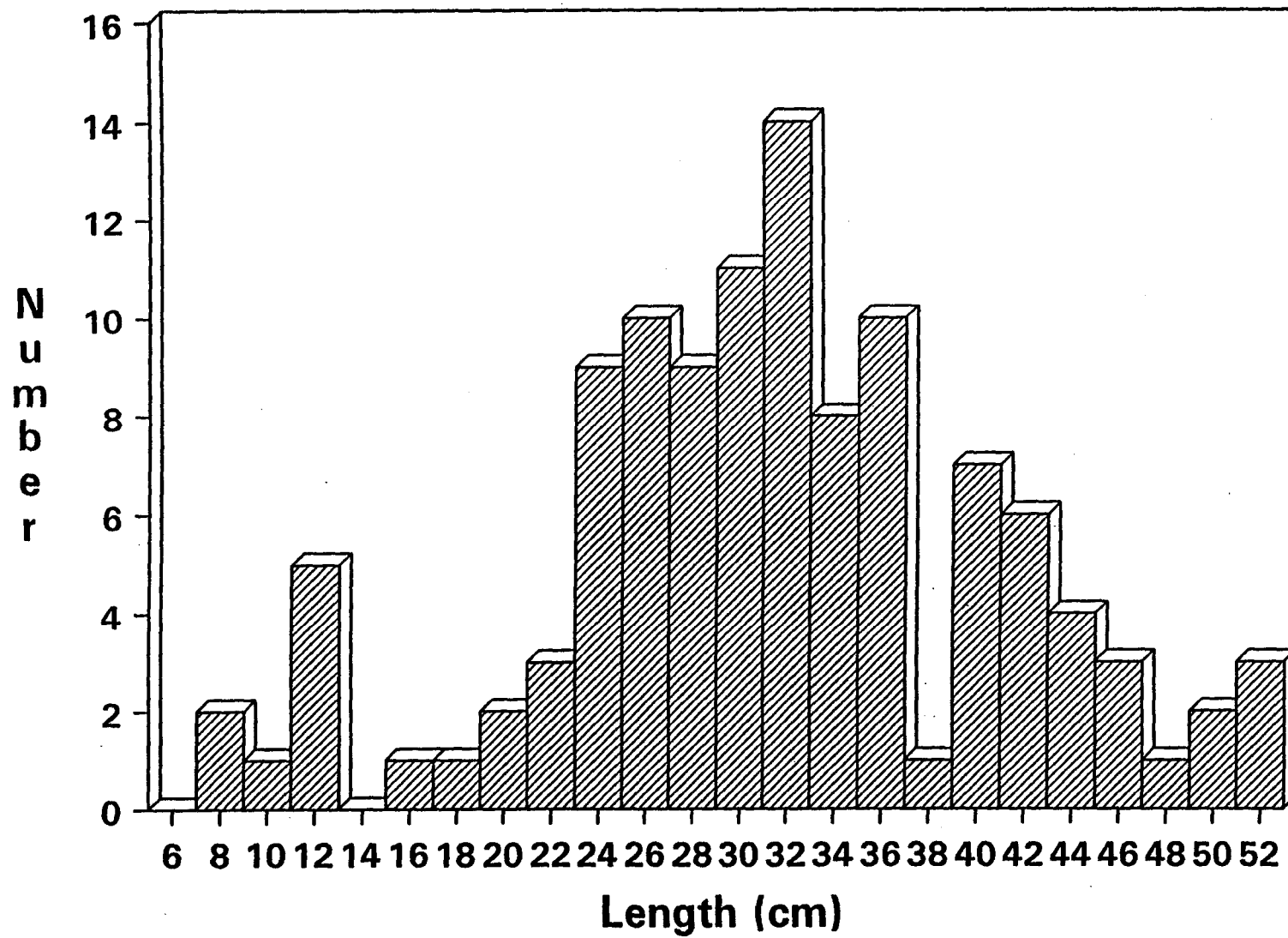


Figure 2. Length frequency of largemouth bass collected in Hayden Lake by electrofishing, June and July 1991.

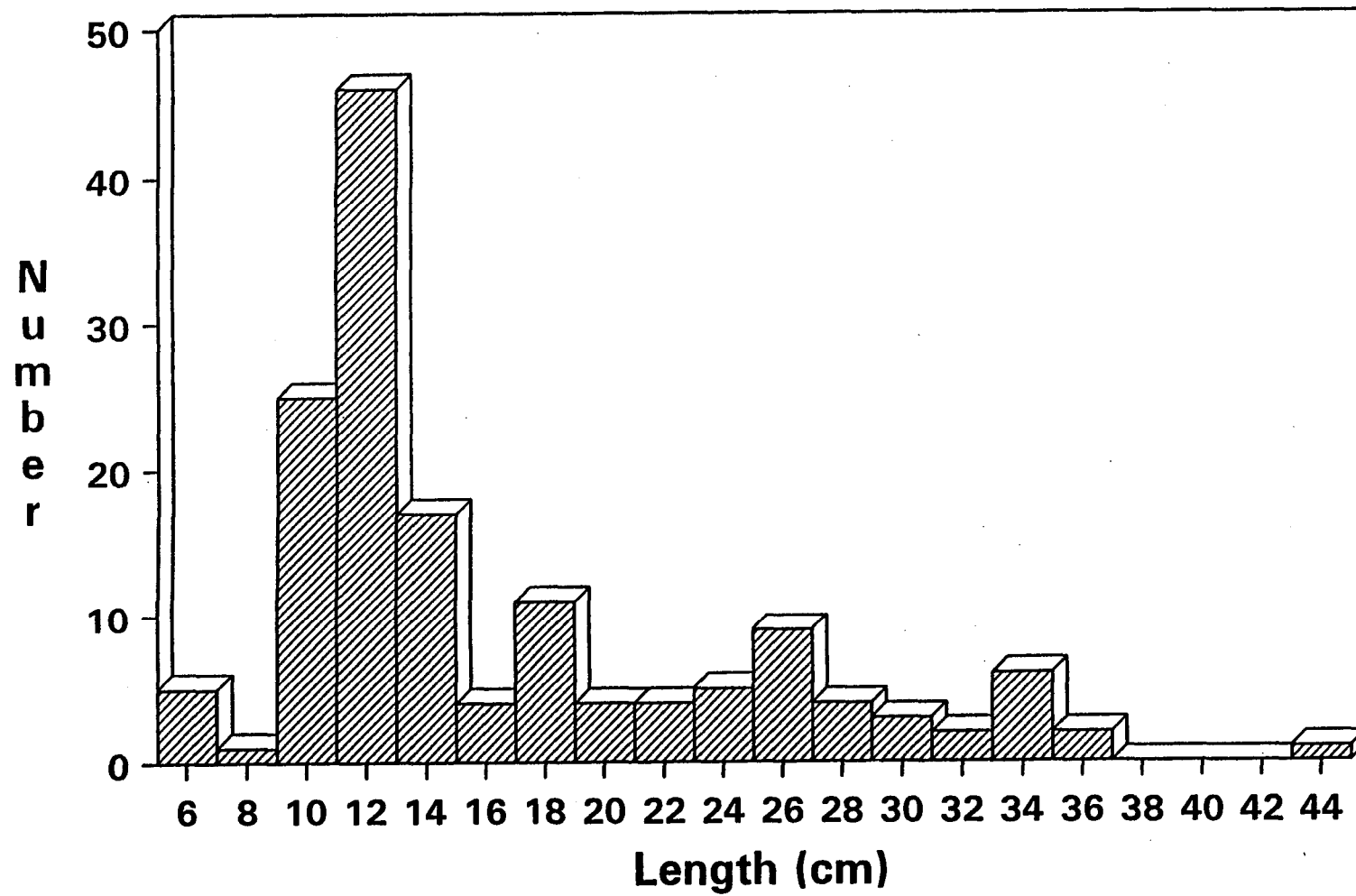


Figure 3. Length frequency of smallmouth bass collected in Hayden Lake by electrofishing, June and July 1991.

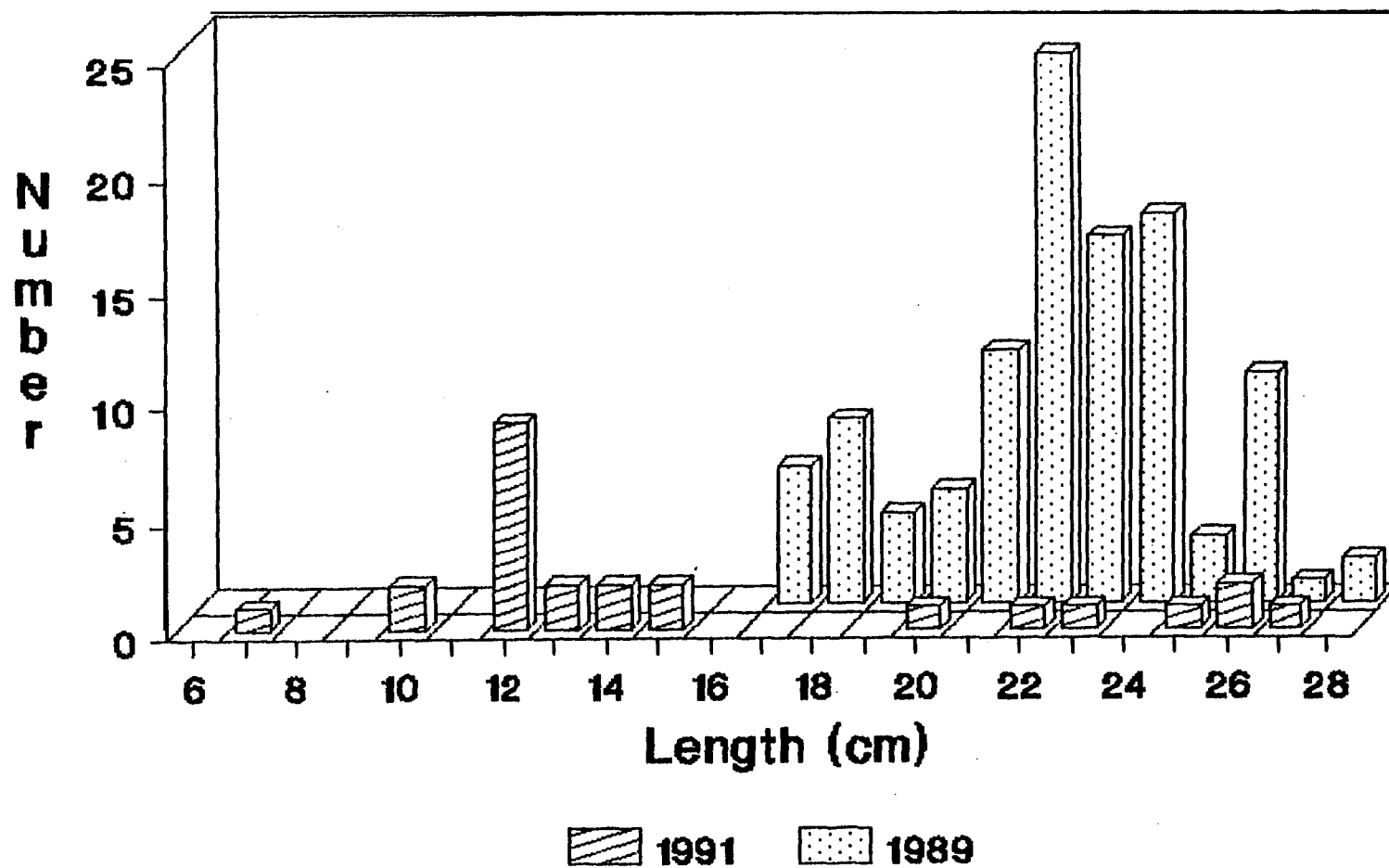


Figure 4. Length frequency of black crappie collected in Hayden Lake by electrofishing, 1989 and 1991.



The largemouth bass population in Hayden Lake (with a minimum stock size of 200 mm) had an RSD-30 of 69 in 1989, 36 in 1990, and 68 in 1991. For an RSD-40, 1989=29, 1990=18, and 1991=25. The smallmouth bass in Hayden Lake in 1991 (with a minimum stock size of 180 mm) had an RSD-30 of 27 and an RSD-40 of 2. The limited number of black crappie sampled in 1991 precluded the estimation of RSD's.

Scale samples from largemouth bass show it requires four years of growth to attain the minimum stock size of 200 mm and five years to reach 305 mm (12 inches). Another eight to nine years are needed to grow to 406 mm (16 inches).

Smallmouth bass grow to the minimum stock size of 180 mm in three years and attain the lower end of the slot limit (12 inches) in five years. The smallmouth bass in excess of 406 mm (16 inches) are eight to nine years old. Black crappie require five years to grow to 250 mm (10 inches), the minimum size limit.

### Discussion

As evidenced by the RSD's and length frequency distributions (Figure 2), largemouth bass were not "cropped-off" at the old legal size limit of 356 mm (14 inches). With the new size limits, there appears to be sufficient numbers (RSD-40 = 25) in excess of the upper size limit (406 mm) of largemouth bass to afford a good fishery. The smallmouth bass population in Hayden Lake is only now starting to enter the size range of the old legal size limit (Figure 3), and it will be several years before any significant number of smallmouth bass occupy the upper limit of the new regulations. The lower size limit (305 mm) could provide a control on the population expansion of smallmouth bass in Hayden Lake and maintain existing good growth rates.

The significance of length frequency distribution of black crappie in Hayden Lake is difficult to interpret due to the limited sample size. Electrofishing efforts were not directed at collecting crappie, and the data is not indicative of the population. It does appear, however, that there is a good distribution of all age classes, but when you compare 1991 data with 1989 data (Figure 4), there were fewer large size crappies in the catch. Existing data on the black crappie population in Hayden Lake is insufficient to make any judgements as to the difference between the two years at this time. Future monitoring is needed to assess what effect the new regulations will have on the smallmouth and largemouth bass and black crappie in Hayden Lake.

## **MIRROR LAKE**

### Introduction

Mirror Lake was rotenoned October 8, 1991 to remove an unwanted population of black crappie. Mirror Lake provided a good consumptive fishery for cutthroat trout, brook trout, brown trout, and kokanee salmon prior to the illegal introduction of crappies in the early 1980s. Public comment indicated a desire to restore Mirror Lake to a salmonid only fishery. With the presence of numerous other warmwater/coolwater fisheries in the vicinity, it was determined that the loss of the crappie fishery in Mirror Lake would not be greatly missed. Mirror Lake will be only the fourth small lowland lake in north Idaho to offer salmonid only fishing. The other three lakes are Jewel and Solomon, which are managed as quality trout fisheries, and Sinclair Lake which is managed with general fishing regulations and stockings of put-and-take rainbow trout. Mirror Lake will be managed with general regulations to provide the consumptive type fishery it offered previously.

Restocking with fingerling Westslope cutthroat trout (10,000), brook trout (7,000), and kokanee salmon (5,000), is scheduled to occur in the spring of 1992. In addition, approximately 19,700 "put-and-take" hatchery rainbow trout will be stocked in 1992 to reestablish the fishery while the fingerling fish recruit to the fishery.

### Methods and Results

Bathymetric mapping and volumetric calculations of the 39.86 ha Mirror Lake yielded a total volume of 2,875.68 acre-feet, or 937,044,501 gallons of water. The treatment level of 1.25 ppm of rotenone was determined by bioassay results and the desire to attain a complete kill of the fish populations in the lake. The lake was treated with 1,170 gallos of 2.5% synergized Chem Fish rotenone. Application procedures utilized methods to disperse the Chem Fish at the surface and below the thermocline to assure complete mixing of the chemical throughout the stratified lake waters.

Pretreatment sampling, June 20, 1991, with electrofishing gear indicated the fish community in Mirror Lake was dominated by black crappie. During 24 minutes 37 seconds of electrofishing effort, 467 black crappie, ranging from 55 mm to 240 mm, were collected (Figure 5). In addition, seven brown trout, ranging from 115 mm to 490 mm, and one brook trout, 210 mm, were collected. The small brown trout collected were from a hatchery stocking that occurred earlier in June. Natural reproduction of brown trout is not known to occur in Mirror Lake.

Analysis of scale samples taken from crappie showed that fish in the 200 mm range were 5+ years old. Utilizing fish marked prior to treatment and recovered after treatment, the crappie population was estimated at 94,806 (95% CI=53,886 and 250,409). This equates to 58.9 pounds of crappie/acre.

During the post-treatment collection of dead fish, a brown trout (up to 660 mm), 4 cutthroat (up to 349 mm), 59 kokanee salmon (up to 362 mm), 1 brook trout (330 mm), and 1 goldfish were also collected. In addition to the larger Kokanee salmon sampled, juvenile Kokanee were also collected. There has not been any recent stockings of Kokanee in Mirror Lake; these fry were from natural reproduction in the system. No population estimates were made on any species other than the crappie because of the low numbers collected.

Post-treatment sampling, December 3 and 4, 1991, with trap nets, floating and sinking gill nets, and electrofishing yielded no fish. From bioassay results obtained December 3, 1991, Chem Fish concentrations were estimated to be approximately 0..5 ppm. Nine cutthroat trout (80 mm to 125 mm in length), were suspended at various depths in Mirror Lake. After 1 hour and 15 minutes, four of the fish were dead and the remaining five had lost equilibrium. A second bioassay was conducted on March 26, 1992. Four cutthroat trout (120 mm to 140 mm in length) were placed in Mirror Lake, and after six hours, the fish were alive and appeared healthy. At this time the lake was considered to be detoxified. Brook trout, 100mm in length, and rainbow trout, 250 mm in length, were stocked in Mirror Lake in April of 1992. Cutthroat trout and kokanee salmon will be stocked later in the spring of 1992 when they are available from the hatchery system.

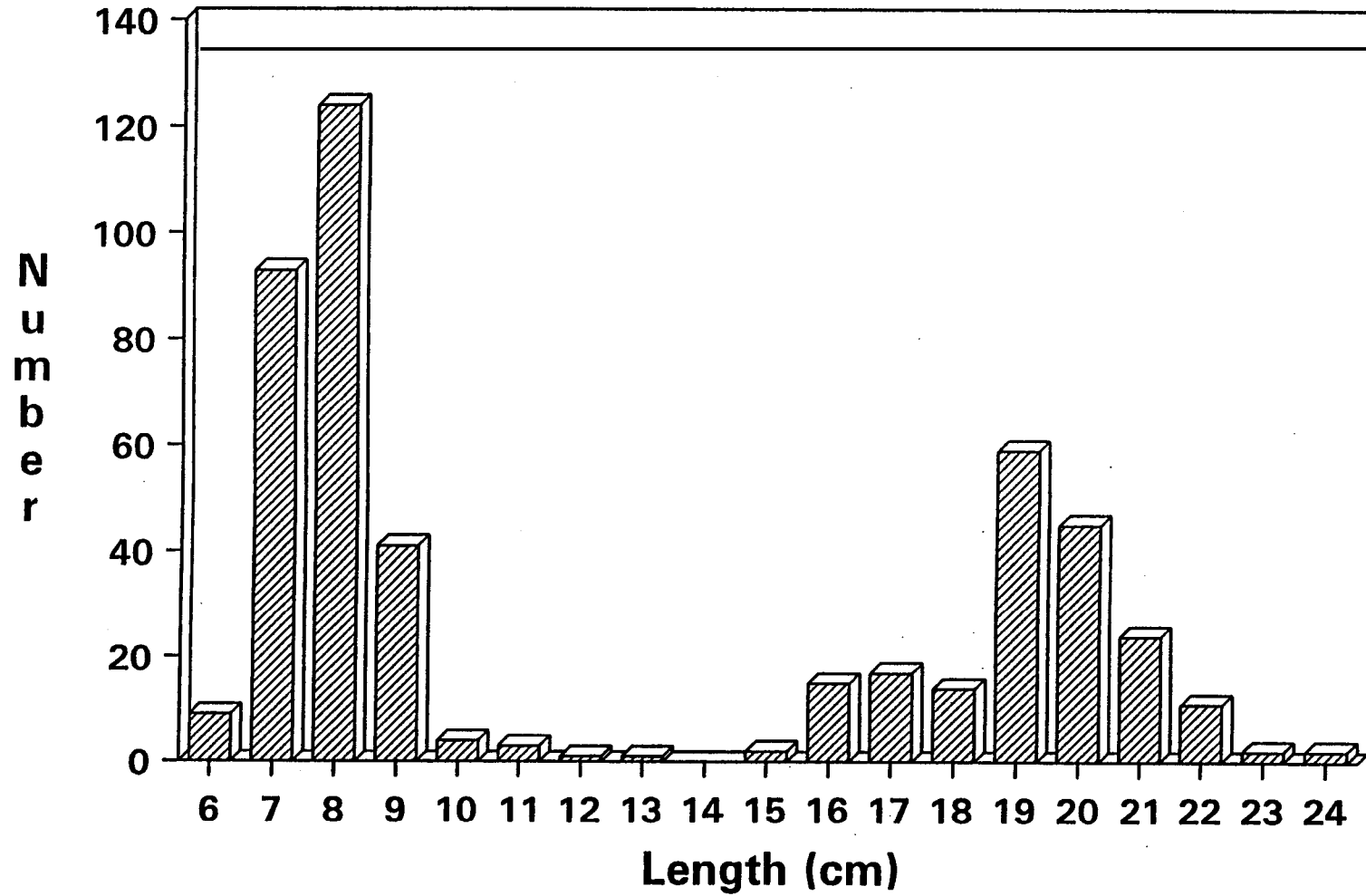


Figure 5. Length frequency of black crappie collected in Mirror Lake by electrofishing, June 20, 1991.

## **SPIRIT LAKE**

### **Introduction**

Spirit Lake (520 ha) is a two-story fishery of both salmonid and warmwater fish. Kokanee and catchable rainbow trout support most of the fishing effort. The kokanee fishery in Spirit Lake is considered to be one of the best in the region because of its high yield per hectare. The lake is managed with general regulations, except the kokanee bag limit is 25 fish per day and 50 in possession. The lake is open year-round.

### **Methods**

Kokanee were sampled with a midwater trawl, and trawling methodology and statistical analysis were as described by Bowles (1987). Five trawls were conducted at random locations, and trawling was conducted during the new moon phase on August 12, 1991 (Figure 6). The net was 18.7 m long with a 3 m by 3 m mouth; mesh sizes (stretch measure) graduated from 32, 25, 19, and 13 mm in the body of the net to 6 mm in the cod end. The midwater trawl was towed by an 8.5 m 140-horsepower diesel engine boat at a speed of 1.5 m/s. The kokanee were located at a depth between 7.6 m and 18.3 m. This vertical distribution of kokanee was divided into 3.5 m layers and a standard 3.5 minute tow was made in each layer, sampling 2,832 m<sup>3</sup> of water over a distance of 315 m. Kokanee salmon were divided into age classes by peaks in the size frequency distribution.

Kokanee abundance was calculated by two methods. The first method has been used since 1981 and described by Bowles et al. (1987)  $(A \times B \times C \times D) / F \times G = N$  where:

A = depth sampled,  $(d_{\text{lowest}} - d_{\text{highest}}) + 10$

B = number of fish sampled per age group

C = area (ha) of the section sampled or lake area sampled

D = 1.076317 Speed/vol factor

F = Number of transects in section (5)

G = Number of STEP per transect (average of 5 trawls)

N = Estimated numbers of fish

The second method is a computer model recently developed by Bruce Rieman and Debbie Meyers and described by Maiolie and Davis (in progress).

### **Results.**

The population estimates of kokanee salmon in Spirit Lake, ages 0, 1, 2, 3 and 4, were 682,221, 326,634, 135,066, and 41,346, respectively, using the method described by Bowles et al. (1987) (Table 2). The estimates using the new computer model were 472,234, 148,698, 63,161 and 19,248 for age 0, 1, 2, 3, and 4, respectively (Table 2). Model lengths for age 0, 1, 2, 3, and 4, were 49 mm, 155 mm, 195 mm, and 245 mm, respectively. All kokanee over 220 mm were mature and all kokanee under 220 mm were immature.

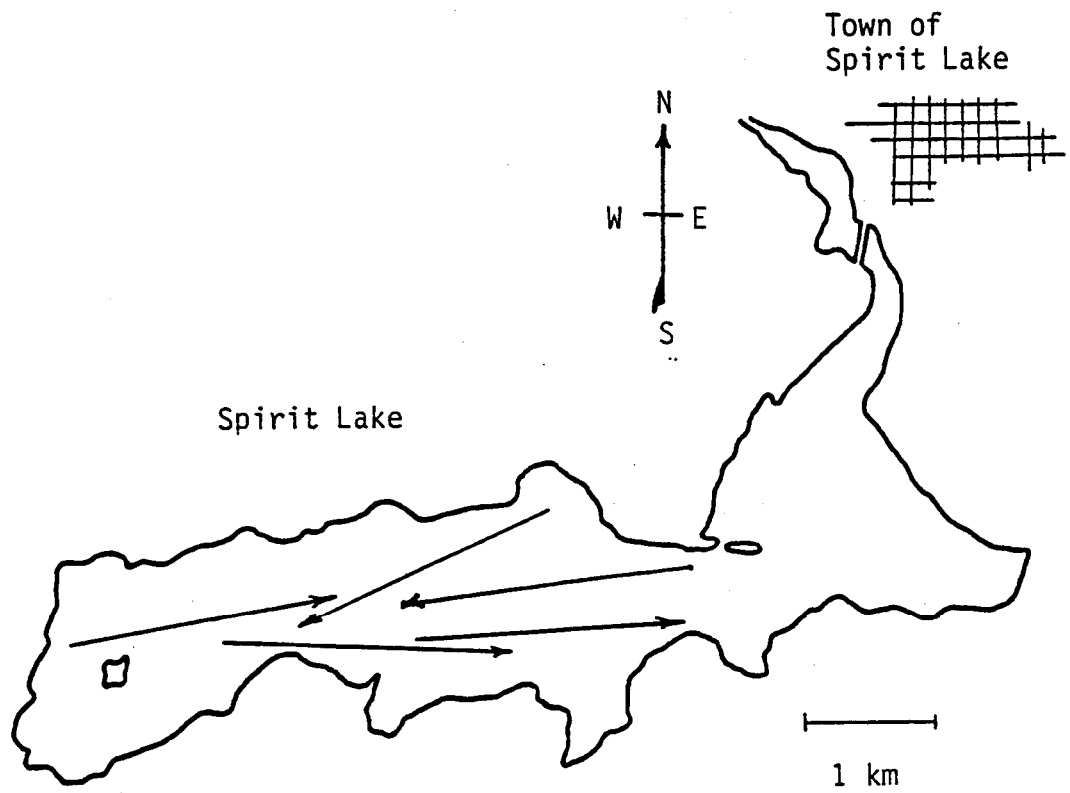


Figure 6. Location of five trawling sites in Spirit Lake, 1991.

Table 2. Estimates of kokanee salmon year classes (1977-1990) made by midwater trawling in Spirit Lake, Idaho, 1981-1991. Estimates are in thousands of kokanee.

| Year classes | 1991 <sup>a</sup> | 1991  | 1990  | 1989               | 1988              | 1987              | 1986              | 1985               | 1984  | 1983  | 1982  | 1981  | 8 <sup>AA</sup> |
|--------------|-------------------|-------|-------|--------------------|-------------------|-------------------|-------------------|--------------------|-------|-------|-------|-------|-----------------|
| 1990         | 472.3             | 682   |       |                    |                   |                   |                   |                    |       |       |       |       | a               |
| 1989         | 148.71            | 327   | 149.3 |                    |                   |                   |                   |                    |       |       |       |       |                 |
| 1988         | 63.2              | 135   | 399.2 | 120.2 <sup>b</sup> |                   |                   |                   |                    |       |       |       |       |                 |
| 1987         | 19.2              | 41    | 112.8 | 130.5              | 71.1 <sup>c</sup> |                   |                   |                    |       |       |       |       |                 |
| 1986         |                   |       | 90.3  | 223.2              | 225.8             | 46.3 <sup>d</sup> |                   |                    |       |       |       |       |                 |
| 1985         |                   |       |       | 85.8               | 92.4              | 178.7             | 16.6 <sup>e</sup> |                    |       |       |       |       |                 |
| 1984         |                   |       |       |                    | 156.3             | 347.5             | 287.3             | 164.4 <sup>f</sup> |       |       |       |       |                 |
| 1983         |                   |       |       |                    |                   | 97.6              | 107.9             | 206.8              | 3.5   |       |       |       |                 |
| 1982         |                   |       |       |                    |                   |                   | 56.5              | 113.2              | 17.4  | 143.3 |       |       |                 |
| 1981         |                   |       |       |                    |                   |                   |                   | 74.3               | 160.8 | 272.6 | 526.0 |       |                 |
| 1980         |                   |       |       |                    |                   |                   |                   |                    | 103.1 | 146.8 | 204.0 | 281.3 |                 |
| 1979         |                   |       |       |                    |                   |                   |                   |                    |       | 54.2  | 37.7  | 73.4  |                 |
| 1978         |                   |       |       |                    |                   |                   |                   |                    |       |       | 48.0  | 82.1  |                 |
| 1977         |                   |       |       |                    |                   |                   |                   |                    |       |       |       | 92.6  |                 |
| Age          |                   |       |       |                    |                   |                   |                   |                    |       |       |       |       |                 |
| 1, 2         |                   |       |       |                    |                   |                   |                   |                    |       |       |       |       |                 |
| 3, 4         | 231               | 503   | 602.3 | 439.5              | 474.5             | 623.8             | 451.7             | 394.3              | 281.3 | 473.6 | 314.7 | 248.1 |                 |
| Total        | 703.4             | 118.5 | 751.6 | 559.7              | 545.6             | 670.1             | 467.7             | 558.7              | 284.8 | 616.8 | 840.7 | 529.4 |                 |
| Nu/ha        | 1,190             | 2,005 | 1,312 | 977                | 952               | 1,169             | 816               | 975                | 497   | 1,076 | 1,467 | 924   |                 |

<sup>a</sup>Totals calculated by new methods as described in Maiolie and Davis (in progress).

<sup>b</sup>75,000 kokanee fry released in 1988.

<sup>c</sup>60,800 kokanee fry released in 1987.

<sup>d</sup>57,142 kokanee fry released in 1986.

<sup>e</sup>109,931 kokanee fry released in 1985.

<sup>f</sup>100,000 kokanee fry released in 1984.

## Discussion

Fry abundance in 1991 was the highest estimate in the past ten years (Table 2). The high fry estimate was due to trawling in August instead of July as in previous years. The later trawling date allowed the fry time to move into open water becoming more vulnerable to the trawl. Kokanee fry were stocked from 1984-1988 to supplement apparent weak year classes. The estimates were made in July in previous years to determine if the year class was weak, but July was too early for a reliable estimate. Kokanee fry stocking was discontinued after 1988.

The 1991 age 3 and age 4 kokanee estimate (the age groups are combined) was the lowest in the past ten years (Table 2); this was the last year class to have received supplemental fry stocking. There may be a trend developing in Spirit Lake of one very strong group of 3- and 4-year-old kokanee followed by three weaker groups (Table 2). In 1984, there was a large group of age 3 and age 4 kokanee from the 1980 year class. In 1988, there was another large group of age 3 and age 4 fish from the 1984 year class. The 1988 year class should produce a strong group of 3- and 4-year-old kokanee in 1992 if the trend continues.

## COEUR d'ALENE LAKE

### Northern Pike Fishery

#### **Introduction**

The northern pike fishery in the Coeur d'Alene Lake system has expanded throughout the various bays since their illegal introduction in the early 1970s (Figure 7). A study on northern pike was conducted in the Coeur d'Alene Lake system in 1989-90 (Rich, in progress). Several conclusions were reported; the northern pike were present in low densities ranging from 2.8 to 5.0 kg/ha, they had high growth rates, angler exploitation ranged 30% to 50%, there were no major migration patterns, and predation on native westslope cutthroat trout and kokanee as significant at certain time of the year.

Prior to 1991, the major pike fishing effort took place in April, May, and June. In March 1991, a new state record pike was caught prior to spawning. The number of anglers fishing for northern pike increased dramatically. Three more state record northern pike were harvested by the middle of April 1991. Concern was expressed about the perceived "overharvest" of northern pike on Coeur d'Alene Lake. A creel survey was initiated during the spring fishery in 1991 to quantify angler effort and harvest of northern pike.

#### **Methods**

A creel survey was conducted from March 23 to April 14, 1991 on Cougar Bay located at the northwest end of Coeur d'Alene Lake (Figure 7). A standard creel survey was set up to include angler interviews and instantaneous angler counts. There was only one section and one interval. There were two day types; weekends and weekdays. These were further divided into morning and afternoon sessions. Instantaneous angler counts were made twice during each session, the number of shore anglers and the number of boats were recorded. Count times were randomly selected for each session. The morning session was 0600-1300, the afternoon session was 1300-1830. Angler interviews were conducted between counts. Number of anglers per group, total hours fished, and total fish caught were recorded.

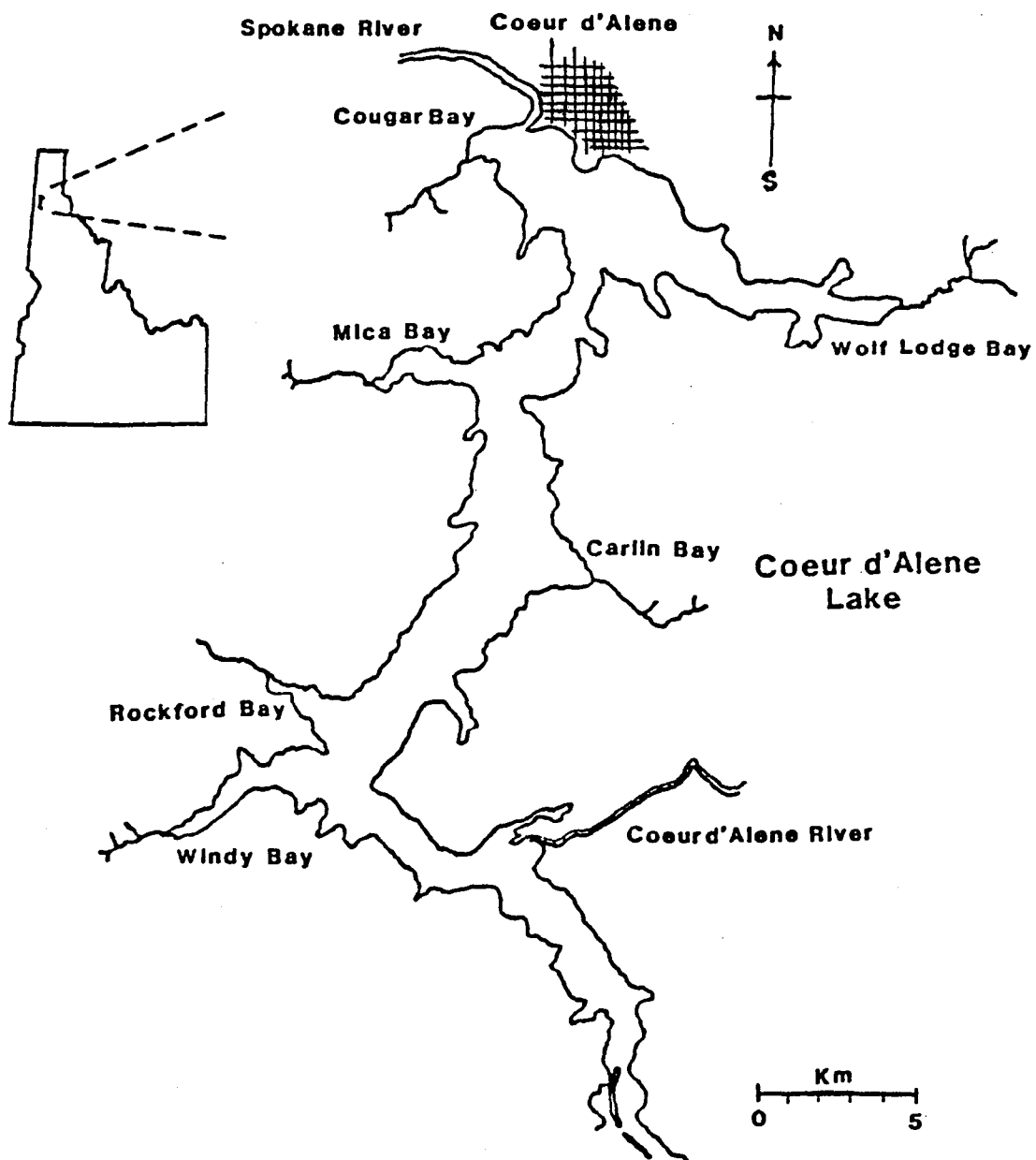


Figure 7. Map of Coeur d'Alene Lake, Idaho.



A computer program, designed by Tom McArthur, was used to calculate the estimated total angler hours and northern pike harvested.

## Results

Anglers expended an estimated 14,685 (+/-2683 @ 95% C.I.) during the four-week period. An estimated total of 832 (+/- 546 @ 95% C.I.) northern pike were caught. Harvest of northern pike was estimated to be 672 (+/- 349 @ 95% C.I.). The catch rate was 0.057 fish/h or 17.7 hrs/fish. Mean length of northern pike harvested was 591 mm (range 356-813 mm, N=30) (Figure 8).

## Discussion

These catch and harvest estimates represented minimums and did not include the first three weeks of the fishery. Rich (in progress) estimated the northern pike population in Cougar Bay in 1990 to be between 380-994 fish ( $p=0.05$ ) with an exploitation rate between 30% to 50% in Cougar Bay in 1990.

The estimated harvest of northern pike in Cougar Bay in 1991 ranged from 323 to 1,021 fish ( $p = 0.05$ ), but a population estimate was not made. This level of harvest relative to the populations estimate in 1990 represents a very high, but unquantified level of exploitation. If this type of exploitation rate were sustained, it would result in a significant reduction in the pike population, especially larger fish.

Cougar Bay represents only one bay on Coeur d'Alene Lake where pike are present. In addition, there are areas in Cougar Bay where pike are not vulnerable to anglers. Given the high reproductive potential of northern pike, we anticipate pike to persist in the system, but both population density and structure will be modified by angler harvest.

Predation by northern pike on other desirable game fish species was significant in 1990. Westslope cutthroat trout were selected as prey items in a higher proportion than they were found in the littoral fish community. They made up 20% of the diet of pike by weight during the spring and fall. An estimated 2,500 to 4,200 cutthroat were consumed by pike in Cougar Bay in 1990 (Rich, in progress). Kokanee were also found in high abundance in pike stomachs during the fall when they come into the shoreline to spawn. Kokanee comprised 58% by weight of the pike diet in Cougar Bay in the fall of 1990 (Rich, in progress).

The exceptional growth rates of pike in Coeur d'Alene Lake (all four 30+ lb fish harvested in 1991 were age 7+) were the result of both high forage availability and relatively low pike densities. This type of growth does not exist anywhere else in the world on a sustained basis and we do not expect it to be maintained in Coeur d'Alene Lake.

Northern pike in Coeur d'Alene Lake have provided a popular sport fishery, but not without impacts to other popular sport fisheries. Angler effort has increased dramatically due to the exceptional trophy fishing of 1991, and will likely remain relatively high.

It is not possible to maintain the pike fishing anglers experienced in Cougar Bay in 1991. Pike growth rates will decline as the forage base is depleted and would be similar to waters found at the same latitude as Coeur d'Alene Lake.

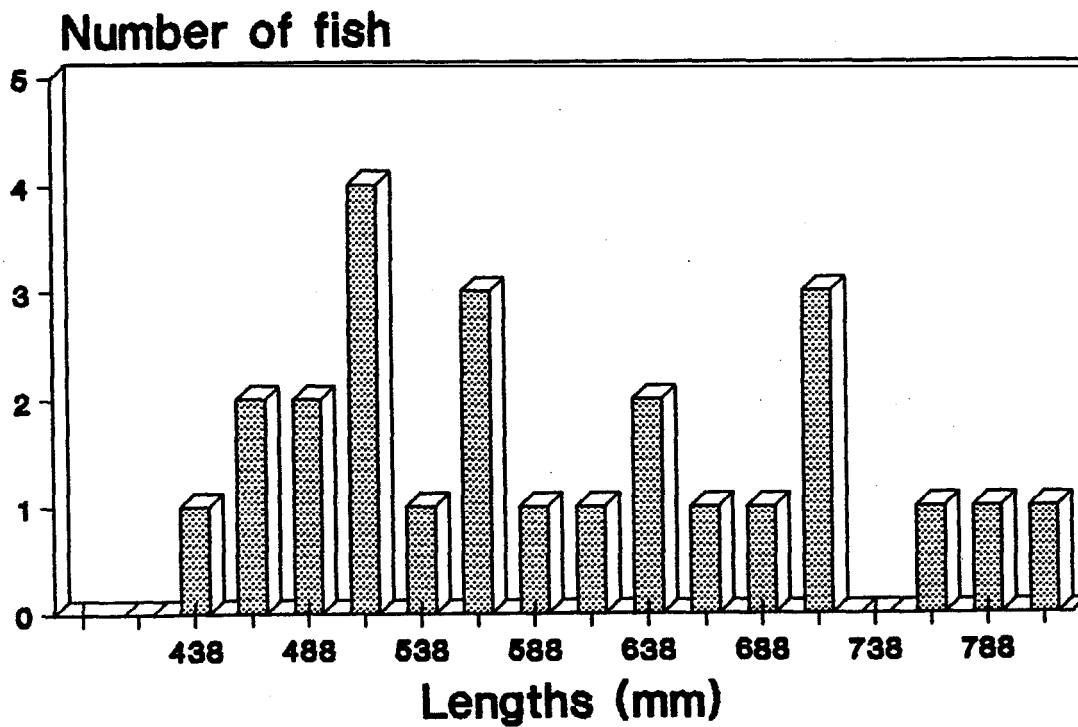


Figure 8. Length frequency of northern pike (n=30) harvested from Cougar Bay, Coeur d'Alene Lake, April 1991.

Angler effort for pike has increased. The trophy fishing of 1991 created nationwide publicity that is likely to result in high angler effort relative to what was present in years prior to 1991 despite reductions in both catch rates and size of fish caught.

Managing specifically for trophy pike would require both harvest restrictions and would have negative impacts on other sport fisheries. Harvest opportunity would need to be significantly reduced to allow more fish to live longer and grow to trophy size. Higher pike densities would in turn result in significant predation on desirable game fish such as cutthroat, kokanee, and bass. As the forage base is depleted, we would expect pike growth rates to decline further. What occurred in 1991 was unique and simply cannot be sustained.

Management direction in the 1991-1995 statewide fish management plan allows maximum angler opportunity and harvest of northern pike in Coeur d'Alene Lake. High angler harvest will significantly reduce the number of large pike available to anglers (relative to 1991). Low pike densities will result in maximum growth rates for pike and will reduce predation on other game fish. Trophy pike (fish over 20 lbs) will always be present in Coeur d'Alene Lake, but at a much reduced level relative to the exceptional fishing of 1991.

### RECOMMENDATIONS

1. Monitor length frequency of lake trout in Priest Lake to assess effectiveness of new regulations.
2. Continue bull trout redd counts on index streams in the Lake Pend Oreille drainage and expand surveys to include additional streams.
3. Adjust bull trout survey section on Grouse Creek to end at Flume Creek.
4. Continue to evaluate return to the creel of net pen reared cutthroat trout in Lake Pend Oreille.
5. Continue to evaluate response in population structure to the slot limit and return to the creel of largemouth and smallmouth bass in Hayden Lake.
6. Continue to manage Spirit Lake as a high yield kokanee fishery.
7. Conduct a creel survey to quantify angler exploitation and yield of kokanee in Spirit Lake.
8. Continue to monitor kokanee population status by midwater trawling to determine the relationship between kokanee abundance and the resulting fishery.
9. Do not stock fish predators into Spirit Lake that would interfere with the high yield fishery.
10. Maintain present management direction for northern pike, increase harvest opportunity.
11. Conduct a creel survey on Coeur d'Alene Lake to determine annual harvest of northern pike.

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# **JOB PERFORMANCE REPORT**

State of: Idaho Name: Regional Fishery Management  
Investigations

Project No.: F-71-R-16 Title: Region 1 Lowland Lakes  
Investigations-  
Coeur d'Alene Lake  
Investigations

Job No.: 1-b<sup>2</sup>

Period Covered: July 1, 1991 to June 30, 1992

## **ABSTRACT**

The kokanee Oncorhynchus nerka kennerlyi population in Coeur d'Alene Lake was estimated to be 7.03 million fish. The density of age 3 kokanee was 110 fish/ha. These estimates continue a five-year decline. The kokanee population should be stabilized at 60 to 90 age 3 kokanee/ha.

The mean length of spawning kokanee males was 253 mm and 242 mm for females. The mean number of eggs per female was estimated to be 314. The estimated potential egg deposition was 167 million eggs in Coeur d'Alene Lake.

A total of 42,650 fall chinook salmon O. tshawytscha fingerlings were stocked into Coeur d'Alene Lake in 1991. All fish were marked with a left ventral fin clip. A total of 1,050 of these fish were heat-shocked to produce sterility. These fish were marked with an adipose and left ventral fin clip.

An estimated 325 adult chinook salmon entered Wolf Lodge Creek to spawn in 1991. A total of 297 were trapped. This was the highest number of fish trapped in Wolf Lodge Creek. Hatchery fish comprised 720 of the run and natural fish comprised 28% of the run.

A total of 81 female chinook salmon were spawned. They produced 397,890 eggs.

The catch rate for 13 selected chinook salmon anglers was 19.8 h/fish. In the Big One Chinook Derby, the average catch rate was 63 h/fish.

A total of 14 chinook salmon redds were counted in 1991. Thirteen were in the Coeur d'Alene River and one in the St. Joe River.

Author:

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Regional Fishery Biologist

## INTRODUCTION

Coeur d'Alene Lake is located in north Idaho adjacent to the town of Coeur d'Alene and only 50 km from the major population center of Spokane, Washington. It currently supports approximately 200,000 angler hours, or 20 hours per hectare.

Kokanee salmon Oncorhynchus nerka kennerlyi provided a very popular fishery in Coeur d'Alene Lake since their introduction in 1937, and during the peak of the fishery in the late 1970s, 0.5 million fish were harvested and over 200,000 angler hours were expended. Abundant spawning beds and the lack of a fish predator led to an overpopulation of kokanee. Fall chinook salmon O. tshawtscha were introduced to reduce the kokanee population and promote better growth. A very popular trophy fishery on chinook also developed.

Natural reproduction of chinook salmon has resulted in expansion of the predator population beyond what the kokanee prey base can support on a sustained basis. Continued intensive management of the chinook salmon population and monitoring of kokanee abundance is necessary to maintain the predator-prey balance. The current goal for the program is to provide a consistent chinook salmon and kokanee fishery by maintaining the proper balance.

## OBJECTIVES

1. To determine kokanee stock status in Coeur d'Alene Lake.
2. To evaluate changes in the kokanee population caused by chinook salmon predation (chinook population abundance).
3. To make predictions about future kokanee fisheries based on year class strength and potential egg deposition.
4. To identify all potential chinook spawning areas in the Coeur d'Alene Lake system.
5. To investigate methods to control chinook salmon abundance.

## DESCRIPTION OF STUDY AREA

Coeur d'Alene Lake is Idaho's third largest natural lake (Figure 1). It is located in the Spokane River drainage, which ranges in elevation from 648 m (lake level) to 2,086 m. Most of the drainage is covered by coniferous forest. This area receives some of the largest quantities of precipitation in Idaho, averaging over 76 cm per year, and 70% is snow. Winter temperatures are often below freezing, but Coeur d'Alene Lake does not normally freeze completely.

The lake has a surface area of 12,950 ha and has a volume of 2.75 billion m<sup>3</sup>. The mean and maximum depths are 21.2 m and 61 m, respectively. The major tributaries include the Coeur d'Alene and St. Joe rivers. There are many minor tributaries as well. Coeur d'Alene Lake is the source of the Spokane River which drains into the Columbia River.

Native game fish in Coeur d'Alene Lake and tributary streams included westslope cutthroat trout O. clarki lewisi, bull trout Salvelinus confluentus, and mountain whitefish Prosopium williamsoni. Established introduced species included kokanee, fall chinook salmon, rainbow trout O. mykiss, brook trout S. fontinalis, largemouth bass Micropterus salmoides, smallmouth bass Micropterus

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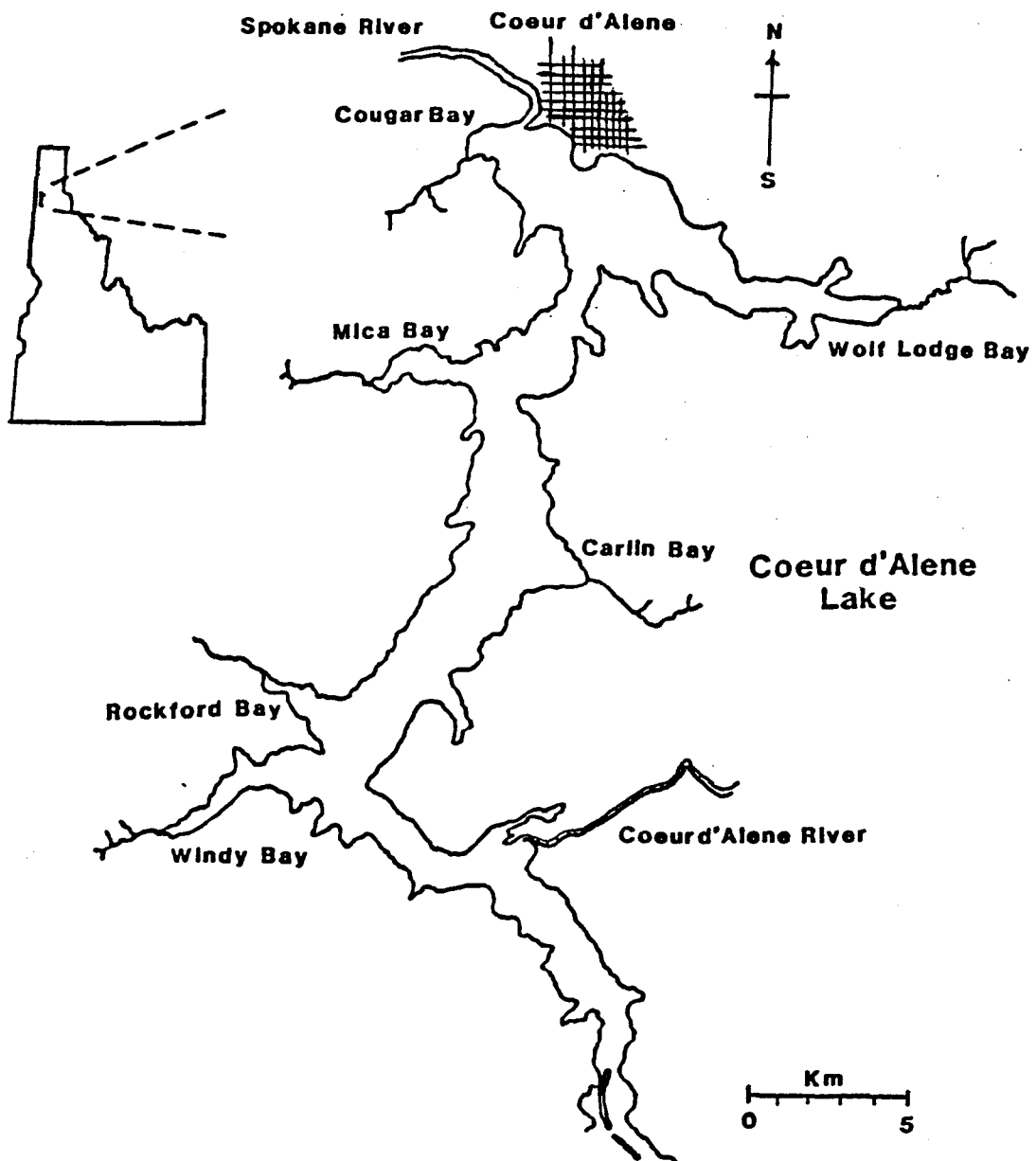


Figure 1. Map of Coeur d'Alene Lake, Idaho.

dolomieu, black crappie Pomoxis nigromaculatus, pumpkinseed sunfish Lepomis gibbosus, yellow perch Perca flavescens, brown bullhead Ameiurus nebulosus, black bullhead Ameiurus melas, channel catfish Ictalurus punctatus, northern pike Esox lucius, and tiger muskie Esox lucius x E. masquinongy.

## **METHODS**

### **Kokanee**

#### **Trawling**

Midwater trawling was used to obtain density estimates of kokanee and representative samples of fish as described by Bowler et al. (1979), Rieman (1990), and Maiolie and Davis (in progress). Seventeen transects were selected throughout Coeur d'Alene Lake (Figure 2).

The number of kokanee of a specific age class collected in each haul was divided by the volume of water sampled to obtain age specific density estimates. These densities were then multiplied by the thickness of the kokanee layer (in m) at the trawling site, and then multiplied by 10,000 to obtain the number of kokanee per hectare at that site. Mean density estimates in each section were summed to make whole-lake population estimates. Parametric statistics were then applied to the density estimates to calculate 90% confidence limits.

Trawl-caught kokanee were measured for total length, and a minimum of 10 fish per 10 mm length group were weighed. Fish greater than 160 mm were examined for maturity. Kokanee scales were removed and impressed in clear plastic laminate sheeting using a Carver Model C laboratory press for age analysis. We exerted 364 kg/cm<sup>2</sup> pressure for approximately 10 seconds to make the impressions. Plastic impressions were then read on an Eberback scale reader.

#### **Length at Spawning**

Total length of kokanee spawners was measured from fish collected in Lake Merwin trap nets during the beginning, middle, and end of the spawning run (December 4, December 13, and December 22, 1991). A total of 170 fish were measured in 1991.

#### **Fecundity**

Number of eggs produced by a known number of females was recorded during the spawntaking operation. In addition, the number of eggs left in the body cavity after spawning was enumerated. Potential egg deposition was then calculated by dividing the number of eggs taken in the spawning operation by the number of females that were spawned, adding the mean number of eggs left in the body cavity, and multiplying by the population estimate of mature female kokanee.

Eggs/female was also calculated by the formula  $y = -947 + 5.26x$ , where  $x$  = kokanee length in mm, and  $y$  = total eggs produced by a female ( $r^2 = 0.84$ ) (B. Rieman, Idaho Department of Fish and Game, personal communication).



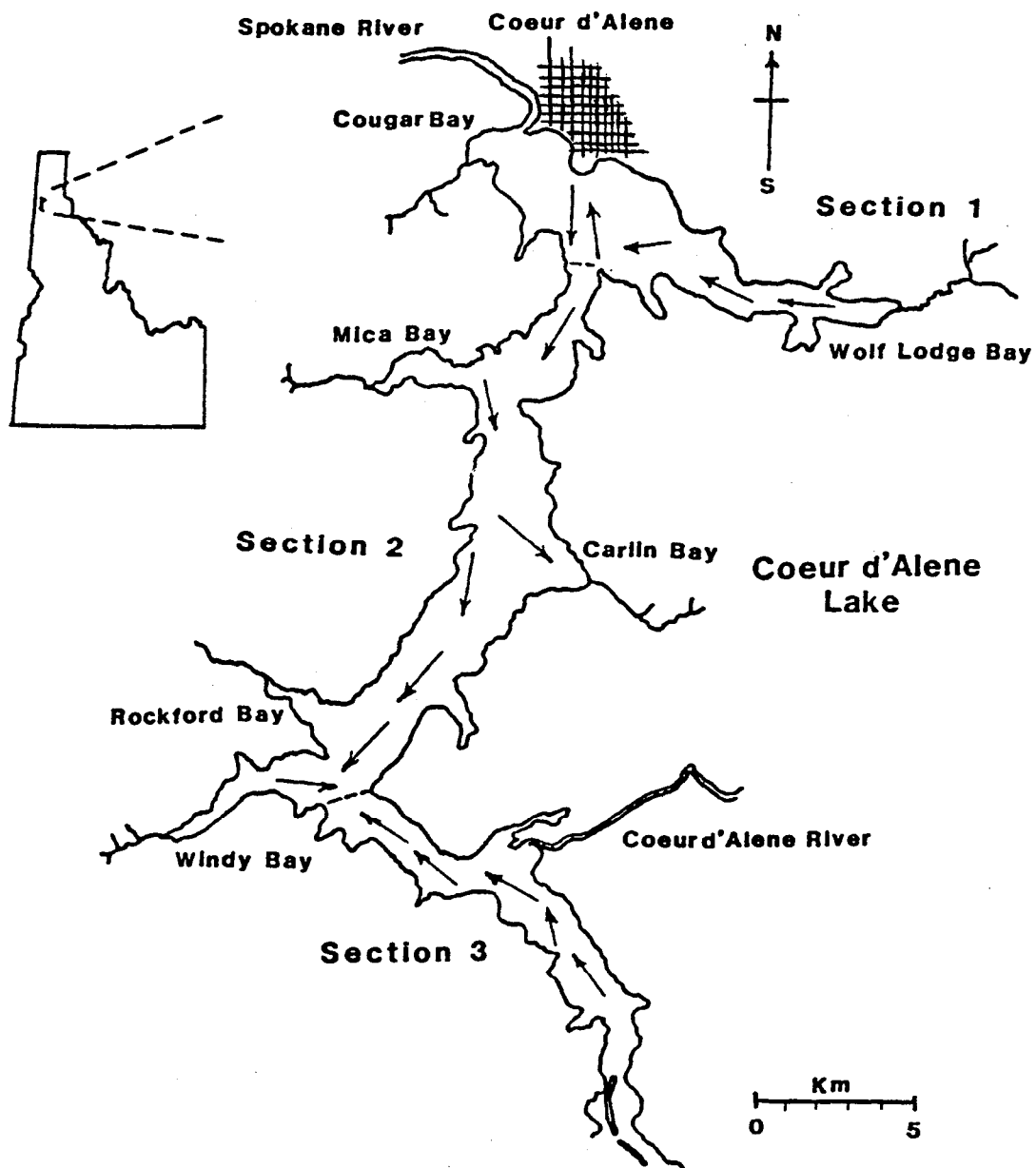


Figure 2. Location of 17 trawling stations on Coeur d'Alene Lake and the three sections used in stratified sampling.

## Chinook

### Stocking

Fall chinook salmon fingerlings (125 to 175 mm) were stocked into Wolf Lodge Bay from the Mineral Ridge boat launch in July. A sample of 100 or more fish were measured and fin clips were evaluated for quality of marks.

### Spawning

**Wolf Lodge Creek**-Trapped chinook salmon were netted and spawned twice weekly in 1991. All fish were measured, sexed, examined for fin clips, and scale samples were taken from all fish. A minimum of 50 pairs of salmon were spawned to maintain genetic diversity. We attempted to control run timing of future runs (selecting for early spawners) by spawning fish that had entered the trap prior to October 1. After the spawning operation ended, the upstream block weir was left in place until mid-December to suppress natural reproduction from late migrating salmon (Figure 3).

**Coeur d'Alene River**-In 1991, a weir was built on the Coeur d'Alene River 2 km below the I-90 Bridge at Cataldo, Idaho (Figure 4). Trapped salmon were measured for total length, examined for fin clips, and scales samples were taken. Female chinook salmon were spawned and male salmon were released upstream immediately after data had been recorded.

### Natural Chinook Salmon Abundance

Starting in 1985, all hatchery chinook salmon were fin-clipped before release. Numbers of fin-clipped (hatchery) and non-fin-clipped (natural) chinook salmon were recorded by age class as the chinook matured and were subsequently trapped in Wolf Lodge Creek. The proportion of natural to hatchery fish was used to estimate natural chinook age 0 production by the equation:

$$N_{\text{age } 0} = (H) ( (W_{\text{age } 2} + (W_{\text{age } 3}) / (C_{\text{age } 2} + C_{\text{age } 3}) )$$

Where: N equals the number of natural chinook salmon at age 0 of year class X, H equals the number of hatchery chinook salmon stocked of year class X, W equals the number of natural chinook salmon in the spawning run of year class X maturing at age 2 and age 3, and C equals the number of hatchery chinook salmon in the spawning run of year class X maturing at age 2 and age 3.

The 1984 natural chinook salmon year class estimate was derived by a different means since chinook salmon were not fin-clipped. It was calculated as a proportion of what was stocked to estimates of natural production by the formula:

$$\frac{0.5 S_{82}}{N_{85}} \pm 0.5 S_{83..} = \frac{0.5 S_{82}}{N_{84}}$$

where:  $N_{84}$  = estimate of natural chinook salmon production in 1984

$N_{85}$  = estimate of natural chinook salmon production in 1985

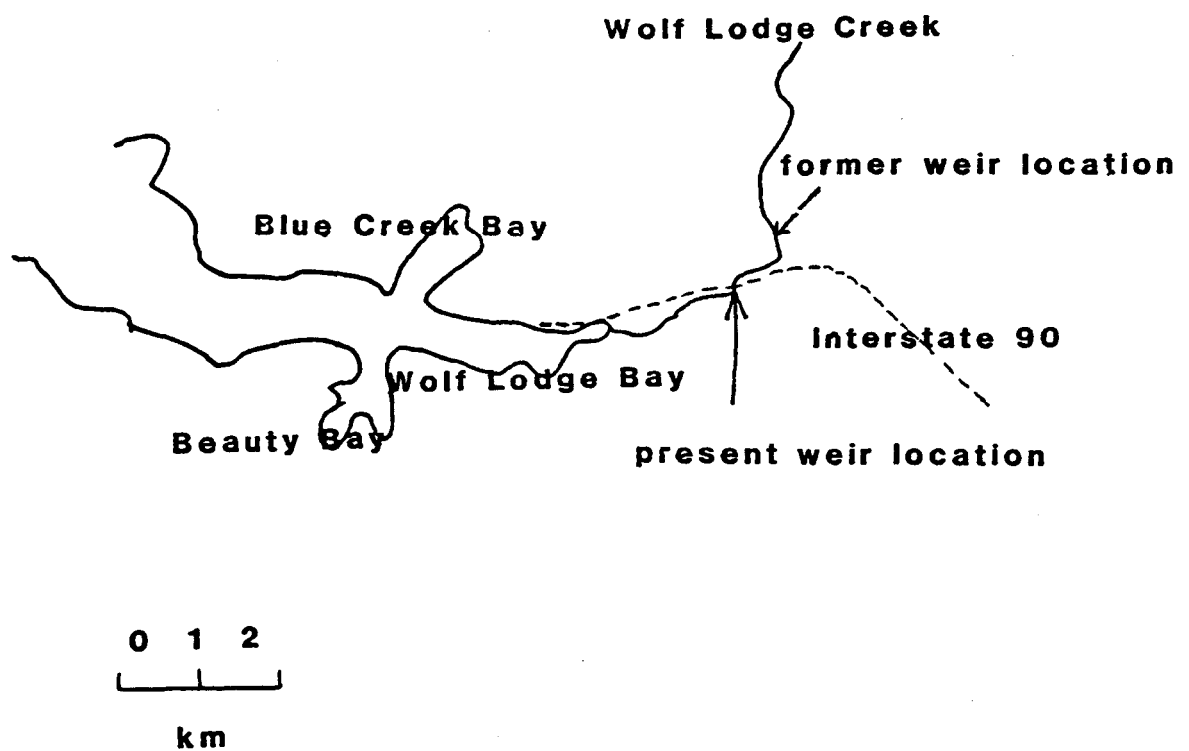


Figure 3. Map of Wolf Lodge Bay and Wolf Creek, Coeur d'Alene Lake showing present and former full chinook weir locations for fall chinook salmon.

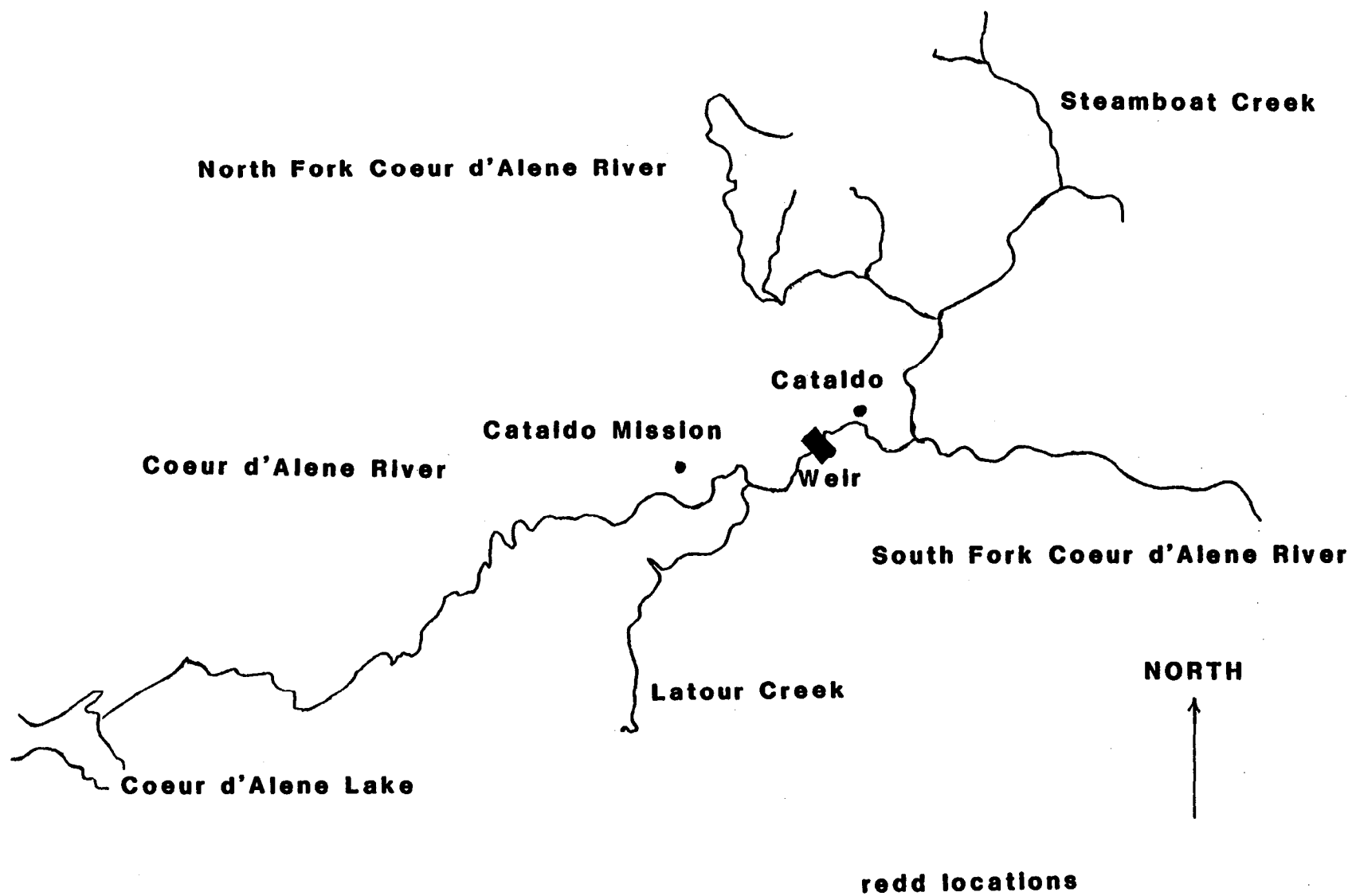


Figure 4. Locations of the weir used to trap fall chinook salmon in the Coeur d'Alene River, 1991.

$S_{82}$  = number of chinook salmon stocked in 1982

$S_{83}$  = number of chinook salmon stocked in 1983

The constant, 0.5, was used to correct for half of the fish maturing at age 2 and half maturing at age 3.

## **Redd Counts**

Aerial redd counts were made on the Coeur d'Alene River, South Fork Coeur d'Alene River, and St. Joe River on October 30, 1991 using a Hiller 2E helicopter.

## **Angler Data**

A group of chinook salmon anglers (13) were asked to record lengths and fin clip location, and remove a scale sample from chinook salmon caught from Coeur d'Alene Lake. Data was recorded from May 1, 1991 to January 31, 1992.

Two types of data were collected during the Big One Derby, August 17-25, 1991. Anglers were asked to fill out and return an angler log containing hours fished per day, length, weight, and fin clip of fish caught during the derby. Also, the length, weight, and fin clip were recorded for all fish officially weighed-in. Percentages of natural fish caught were calculated along with each year class of hatchery chinook salmon.

Anglers fishing below the Coeur d'Alene River weir were interviewed between September 1 to November 8, 1991. Total hours fished and total fish caught were recorded and catch rates calculated.

## **RESULTS**

### **Kokanee**

#### **Trawling**

The kokanee population estimate was 7.03 million fish (+/- 130, 90% error bound) (Table 1). Young-of-the-year (YOY) kokanee (4.04 million) were the largest component of the estimate, and 79% of the YOY were found in the north end of Coeur d'Alene Lake. The estimated density for all kokanee in Coeur d'Alene Lake was 730 fish/ha (Table 2). The estimated density of age 3 kokanee was 110 fish/ha which was above the desired level of 60 to 90 age 3 kokanee/ha.

All kokanee less than 200 mm total length (TL) were immature. All kokanee greater than 210 mm were mature and age 3. All kokanee 200 to 209 mm TL were age 2, and 40% of the fish examined were mature (Figure 5).

Table 1. Kokanee population estimates (in millions) and 90% confidence intervals for each age class in each section of Coeur d'Alene Lake, Idaho, August 6-8, 1991.

| Section | Age 0             | Age 1            | Age 2             | Age 3            | Total                         |
|---------|-------------------|------------------|-------------------|------------------|-------------------------------|
| 1       | 3,143<br>+/- 33%  | 0.093<br>+/- 46% | 0.237<br>+/- 0.4% | 0.19<br>+/- 9%   | 3.66<br>+/- 27%               |
| 2       | 0.849<br>+/- 101% | 0.32%<br>+/- 35% | 1.28<br>+/- 12%   | 0.854<br>+/- 11% | 3.31<br>+/- 15%               |
| 3       | 0.012<br>+/- 46%  | 0.020<br>+/- 49% | 0.006<br>+/- 72%  | 0.019<br>+/- 20% | 0.057<br>+/- 41%              |
| Total   | 4.004<br>+/- 23%  | 0.441<br>+/- 13% | 1.524<br>+/- 7%   | 1.063<br>+/- 6%  | 7.032 <sup>a</sup><br>+/- 13% |

<sup>a</sup> Difference from total in Table is due to rounding.

Table 2. Kokanee density (fish/ha) estimates for each age class in each section of Coeur d'Alene Lake, Idaho, August 6-8, 1991.

| Section            | Age 0 | Age 1 | Age 2 | Age 3 | Total              |
|--------------------|-------|-------|-------|-------|--------------------|
| 1                  | 326.0 | 9.9   | 25.0  | 20.0  | 380.9              |
| 2                  | 88.0  | 34.0  | 133.0 | 89.0  | 344.0              |
| 3                  | 1.3   | 2.1   | 0.6   | 2.0   | 6.0                |
| Whole lake density | 415.3 | 46.0  | 158.6 | 110.0 | 730.9 <sup>a</sup> |

<sup>a</sup> Difference from total in Table is caused by rounding error.

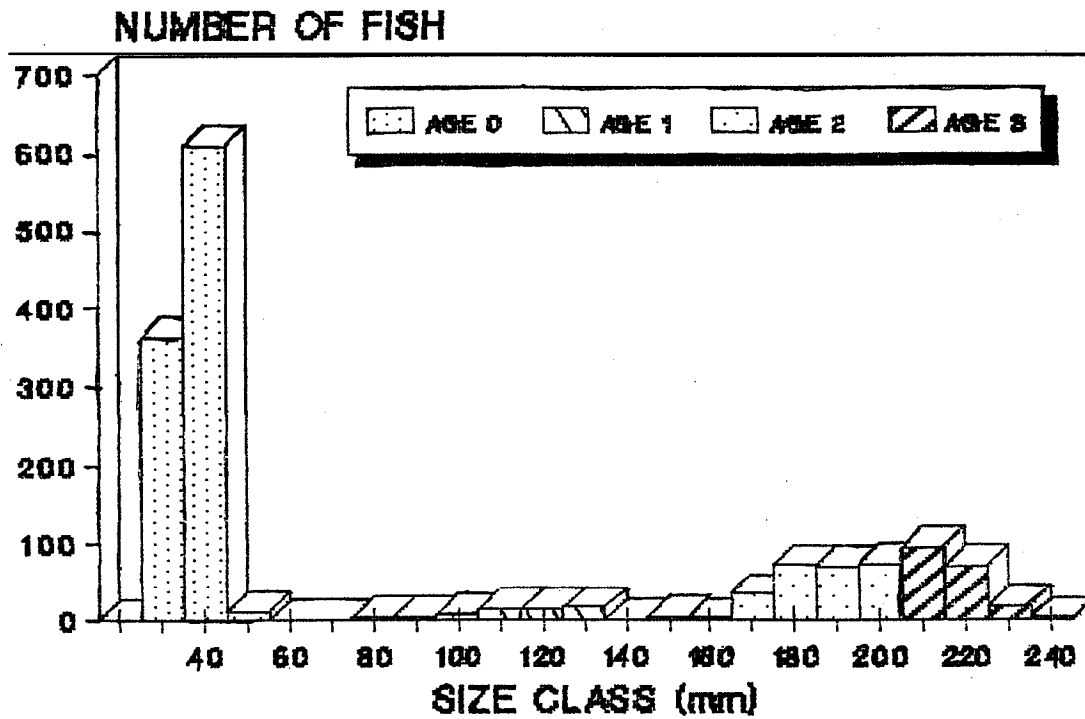


Figure 5. Length frequency and maturity of trawl caught kokanee from Coeur d'Alene Lake, August 1991.

## Spawning

The kokanee spawning operation on Coeur d'Alene Lake collected 15,500 eggs from 50 females in 1991. The number of eggs per female was 310. Mean number of eggs remaining in the body cavity was 4, therefore total eggs per female in 1991 was estimated to be 314. Mean length of female kokanee (n=22) was 242 mm TL and mean length of males (n=148) was 253 mm TL. Using the equation described earlier, eggs per female was 326. Potential egg deposition in Coeur d'Alene Lake was estimated to be 166.9 million (Table 3) using the equation  $1.06 \times 10^6 \times 0.5 \times 314 = Y$ .

Where:  $1.06 \times 10^6$  = Age 3 kokanee abundance  
0.5 = assumes 50% females  
314 = average egg per female  
Y = total egg deposited

## Chinook Salmon

### Stocking

A total of 42,650 fall chinook salmon fingerlings averaging 129 mm TL were stocked into Wolf Lodge Bay, Coeur d'Alene Lake on July 9, 1991 (Table 4). Examination of fin clips for quality indicated 4% of the fish had no clip, 3% of the fish had a poor clip (clip would not be detectable on an adult fish), and 9% of the fish had a fair clip (some growth of the fin would occur but the clip would be detectable). The remainder of the fish (84%) had a good clip.

### Spawning

A total of 397,890 chinook salmon eggs were collected from 81 females trapped in Wolf Lodge Creek and the Coeur d'Alene River during September 13-26, 1991 (Table 5). An estimated 325 fish entered Wolf Lodge Creek and 297 were trapped. The sex ratio was 50/50 for hatchery fish and 60/40 (males to females) for natural fish. Natural chinook salmon comprised 28% and hatchery chinook salmon comprised 72% of the chinook salmon trapped in Wolf Lodge Creek in 1991 (Table 6).

The Coeur d'Alene River weir was put in on August 15, 1991 approximately 2 km below Cataldo, Idaho (Figure 4). It was removed November 8, 1991. A total of 29 chinook were trapped; 59% were natural chinook salmon. Eleven males were released upstream.

### Redd Counts

An aerial count of chinook salmon redds was done in the St. Joe and Coeur d'Alene rivers on October 30, 1991. Thirteen redds were observed in the Coeur d'Alene River, with 11 being below the weir. Only one redd was observed in the St. Joe River (Table 7).



Table 3. Estimates of female Kokanee spawning escapement, potential egg deposition, fall abundance of wild Kokanee fry, and their subsequent survival rates in Coeur d'Alene Lake, 1979-1991.

| Year | Estimated female spawning escapement | Estimated potential number of eggs ( $\times 10^6$ ) | Fall fry from previous year escapement ( $\times 10^6$ ) | Wild survival from previous year escapement |
|------|--------------------------------------|--|--|---|
| 1979 | 256,716                              | 86   | 1.56   | 1.7   |
| 1980 | 501,492                              | 168  | 1.86   | 2.20  |
| 1981 | 550,000                              | 184  | 2.43   | 1.45  |
| 1982 | 358,200                              | 120  | 4.54   | 2.46  |
| 1983 | 441,376                              | 99   | 1.51   | 1.25  |
| 1984 | 316,829                              | 106  | 0.70   | 0.71  |
| 1985 | 530,631                              | 167  | 4.13   | 3.90  |
| 1986 | 368,633                              | 103  | 2.17   | 1.29  |
| 1987 | 377,746                              | 126  | 6.89   | 6.68  |
| 1988 | 362,000                              | 119  | 3.42   | 2.71  |
| 1989 | 516,845                              | 155  | 3.04   | 2.55  |
| 1990 | 657,777                              | 204  | 3.00   | 1.94  |
| 1991 | 531,500                              | 167  | 4.00   | 1.96  |

Table 4. Number, weight, and lengths of fall chinook salmon released into Coeur d'Alene Lake, Idaho, 1982-1991.

| Release date | Release site    | Number released | Length               |       | Rearing Hatchery | Stock of fish               | Mark           |                 |
|--------------|-----------------|-----------------|----------------------|-------|------------------|-----------------------------|----------------|-----------------|
|              |                 |                 | Weight released (kg) | Mean  |                  |                             |                | Range           |
| 07-19-82     | MR <sup>a</sup> | 28,700          | 767                  | 137   | 125-150          | Hagerman                    | Bonneville     | None            |
| 10-05-82     | I-90            | 5,700           | 273                  | 150   | 130-170          | Hagerman                    | Bonneville     | None            |
| Total 82     |                 | 34,400          | 1,040                |       |                  |                             |                |                 |
| 08-09-83     | I-90            | 30,100          | 289                  | 109   | 80-130           | Mackay                      | Bonneville     | None            |
| 10-26-83     | I-90            | 30,000          | 637                  | 124   | 80-150           | Mackay                      | Bonneville     | None            |
| Total 83     |                 | 60,100          | 926                  |       |                  |                             |                |                 |
| 10-29-84     | I-90            | 10,500          | 373                  | 150   | 80-190           | Mackay/Mullan Lake Michigan |                | None            |
| 10-16-85     | I-90            | 11,100          | 409                  | 136   | 100-110          | Mackay/Mullan Lake Michigan |                | LV <sup>b</sup> |
| 10-17-85     | I-90            | 7,400           | 273                  | 143   |                  |                             | Lake Michigan  | Adipose         |
| Total 85     |                 | 18,500          | 682                  |       |                  |                             |                |                 |
| 07-02-86     | I-90            | 29,500          | 375                  | 1,114 | 81-145           | Mackay                      | Lake Michigan  | RV <sup>c</sup> |
| 07-01-87     | I-90            | 59,400          | 900                  | 119   | 62-155           | Mackay                      | Lake Michigan  | Adipose         |
| 07-16-88     | I-90            | 44,600          | 977                  | 133   | 95-180           | Mackay                      | Lake C d'Alene | LV              |
| 07-06-89     | I-90            | 35,000          | 636                  | 126   | 100-165          | Mackay                      | Lake C d'Alene | RV              |
| 07-10-90     | MR              | 35,700          | 626                  | 123   | 80-145           | Mackay                      | Lake C d'Alene | Adipose         |
| 07-10-90     | MR              | 650             | 11                   | 123   | 80-145           | Mackay                      | Lake C d'Alene | Adipose/RV      |
| Total 90     |                 | 36,350          | 637                  |       |                  |                             |                |                 |
| 07-09-91     | MR              | 41,600          | 750                  | 129   | 75-151           | Mackay                      | Lake C d'Alene | LV              |
| 07-09-91     | MR              | 1,050           | 16                   | 129   | 75-151           | Mackay                      | Lake C d'Alene | Adipose/LV      |
| Total 91     |                 | 42,050          | 766                  |       |                  |                             |                |                 |

<sup>a</sup> Mineral Ridge boat ramp

<sup>b</sup> Left ventral  
Right ventral

Table 5. Summary of fall chinook salmon spawntaking operations in Wolf Lodge Creek, Coeur d'Alene Lake, 1984-1991.

| Year | Total fish trapped | Number of fish spawned | Number of females spawned | Number of eggs taken | Eggs per female |
|------|--------------------|------------------------|---------------------------|----------------------|-----------------|
| 1984 | 80                 | 28                     | 13                        | 50,000               | 3,846           |
| 1985 | 0                  | 0                      | 0                         | 0                    | 0               |
| 1986 | 60                 | 46                     | 19                        | <sup>a</sup> 8,700   | NA              |
| 1987 | 50                 | 34                     | 27                        | 105,000              | 3,880           |
| 1988 | 130                | 106                    | 58                        | 210,000              | 3,627           |
| 1989 | 143                | 143                    | 72                        | <sup>a</sup> 53,280  | NA              |
| 1990 | 178                | 166                    | 79                        | <sup>b</sup> 297,340 | 3,498           |
| 1991 | 298                | 181                    | 81                        | <sup>b</sup> 397,890 | 4,789           |

<sup>a</sup> Number of eggs shipped or survived, not total eggs taken.

<sup>b</sup> Totals include totals from Wolf Lodge Creek and Coeur d'Alene River traps.

Table 6. Composition of the spawning run of fall chinook salmon in Wolf Lodge Creek, Coeur d'Alene Lake, 1984-1991.

| Year trapped | Natural fish trapped       |    |     |    |       |    | Hatchery fish trapped |     |     |    |       |     | Year hatchery fish stocked | Fin clip |
|--------------|----------------------------|----|-----|----|-------|----|-----------------------|-----|-----|----|-------|-----|----------------------------|----------|
|              | M                          |    | F   |    | Total |    | M                     |     | F   |    | Total |     |                            |          |
|              | No.                        | %  | No. | %  | No.   | %  | No.                   | %   | No. | %  | No.   | %   |                            |          |
| 1984         | No natural fish return yet |    |     |    |       |    | 22                    | 63  | 13  | 37 | 35    | 100 | 1982                       |          |
| 1985         | No natural fish return yet |    |     |    |       |    |                       |     |     |    |       |     | 1982                       |          |
|              |                            |    |     |    |       |    |                       |     |     |    |       |     | 1983                       |          |
| 1986         | Unknown natural run        |    |     |    |       |    | 19                    | 41  | 27  | 59 | 46    | 100 | 1983                       |          |
|              | Hatchery fish not clipped  |    |     |    |       |    |                       |     |     |    |       |     | 1984                       |          |
| 1987         | 3-year-old fish from 1984  |    |     |    |       |    | 27                    | 79  | 7   | 21 | 34    | 100 | 1984                       |          |
|              | release were not marked    |    |     |    |       |    |                       |     |     |    |       |     | 1985                       | AD & LV  |
| 1988         |                            |    |     |    |       |    | 15                    | 29  | 37  | 71 | 52    |     | 1985                       | AD       |
|              |                            |    |     |    |       |    | 3                     | 100 | 0   | 0  | 3     |     | 1985                       | LB       |
|              |                            |    |     |    |       |    | 5                     | 83  | 1   | 17 | 6     |     | 1986                       | RV       |
| Total        | 25                         | 56 | 20  | 44 | 45    | 42 | 23                    | 38  | 38  | 62 | 61    | 58  |                            |          |
| 1989         |                            |    |     |    |       |    | 3                     | 33  | 6   | 67 | 9     |     | 1986                       | RV       |
|              |                            |    |     |    |       |    | 46                    | 64  | 26  | 36 | 72    |     | 1987                       | AD       |
| Total        | 22                         | 42 | 31  | 58 | 53    | 40 | 49                    | 60  | 32  | 40 | 81    | 60  |                            |          |
| 1990         |                            |    |     |    |       |    | 16                    | 28  | 43  | 72 | 59    |     | 1987                       | AD       |
|              |                            |    |     |    |       |    | 23                    | 80  | 5   | 20 | 28    |     | 1988                       | LV       |
| Total        | 40                         | 46 | 43  | 54 | 83    | 49 | 39                    | 44  | 48  | 56 | 87    | 51  |                            |          |
| 1991         |                            |    |     |    |       |    | 1                     | 14  | 6   | 86 | 7     |     | 1987                       | AD       |
|              |                            |    |     |    |       |    | 41                    | 41  | 60  | 59 | 101   |     | 1988                       | LV       |
|              |                            |    |     |    |       |    | 64                    | 61  | 41  | 39 | 105   |     | 1989                       | RV       |
| Total        | 50                         | 60 | 34  | 40 | 84    | 28 | 106                   | 50  | 107 | 50 | 213   | 72  |                            |          |

Table 7. Counts of fall chinook salmon redds in the Coeur d'Alene and St. Joe rivers, Couer d'Alene Lake, 1989-1991.

| Location                                      | 1989 | 1990 | 1991 |
|---|------|------|------|
| Coeur d'Alene River (Cd'A River)              |      |      |      |
| Cataldo Mission to South Fork (SF) Cd'A River |      | 41   | 13   |
| SF Cd'A River to North Fork (NF) Cd'A River   |      | 10   | 0    |
| NF Cd'A River to Steamboat Creek              |      | 4    | 0    |
| Total   | 52   | 55   | 13   |
| St. Joe River                                 |      |      |      |
| St. Joe City to Calder                        |      | 4    | 0    |
| Calder to Huckleberry Campground              |      | 3    | 1    |
| Huckleberry Campground to Avery               |      | 3    | 0    |
| Total   | 0    | 10   | 1    |
| Grand Total                                   | 52   | 65   | 14   |

## **Coeur d'Alene Lake Fishery**

Seven of the 13 anglers returned data books. These anglers fished 2,599 hours and caught 131 chinook salmon for a catch rate of 19.8 h/fish. Twenty-eight percent of the fish were released. Natural salmon comprised 27% of the reported catch. The 1987, 1988, 1989, and 1990 year classes of hatchery fish comprised 6%, 13%, 38%, and 150 of the catch, respectively.

During the Big One Derby, natural chinook salmon comprised 27% of the fish officially weighed-in (n=115). The 1987, 1988, and 1989 year classes of hatchery chinook salmon comprised 3%, 43%, and 28% of the fish weighed-in. Fifty derby angler logs were returned. Those anglers fished 1,690 hours and caught 27 fish for a catch rate of 63 h/fish (1990 Big One Derby catch rate was 146 h/fish).

## **Coeur d'Alene River Fishery**

An angler survey was conducted on the river below the weir in 1991. A total of 22 anglers fished for 49 hours to catch a total of 6 fish. The catch rate was 8 h/fish.

## **DISCUSSION**

The original goal for the kokanee/chinook salmon program in Coeur d'Alene Lake was to reduce and stabilize the kokanee population at a density that produced age 3 kokanee averaging 250 mm in length. Bruce Rieman (1990, 1991) indicated the density of age 3 kokanee in Coeur d'Alene Lake must be reduced to 40 to 50 age 3 kokanee/ha to attain this goal (age 3 kokanee density in 1991 was 110 fish/ha). The kokanee population becomes very susceptible to collapse when the density of age 3 kokanee is 40 to 50 fish/ha in the presence of a predator. The original goal has been changed to reflect this new information. A more realistic goal would be to reduce and stabilize the kokanee population at a level that produces a density of age 3 kokanee between 60 to 90 fish/ha. This density would provide a fish that is 230 to 240 mm in length to the angler. It would also provide an adequate buffer against collapse of the kokanee population. We would maintain this density by adjusting chinook salmon stocking and controlling natural chinook salmon reproduction.

The goal for the chinook salmon is to provide a stable fishery. Supporting the chinook salmon fishery by stocking a hatchery-reared fish would provide the most consistent fishery. Relying on natural reproduction would provide a fishery characterized by 'boom and bust.' The chinook salmon fishery in Coeur d'Alene Lake will be supported primarily by stocking hatchery-reared fingerlings with some uncontrollable natural reproduction that occurs in Wolf Lodge Creek.

The kokanee population estimates and survival rates have changed dramatically in the past 13 years (Tables 8 and 9, Figures 6 and 7). Between 1979 and 1981, the kokanee population estimates and kokanee survival estimates were stable. These population and survival estimates began to fluctuate after the introduction of fall chinook salmon in 1982. We discovered that stocking more than 60,000 age 0 chinook salmon annually was too high for the kokanee population to support on a sustained basis without declining. Stocking 10,000 age 0 chinook salmon was too low because they could not exert enough predation on kokanee to reduce kokanee density.

The kokanee population has been declining since 1985 (Table 8). The steady decline corresponds to the high age 0 chinook salmon abundance since the 1984

Table 8. Estimates of the abundance of kokanee by year class (1975-1990) made by midwater trawl in Coeur d'Alene Lake, Idaho, 1979-1991. Estimates are in millions of kokanee.

| Year<br>classes <sup>a</sup> | 1991 | 1990 | 1989 | 1988  | 1987  | 1986 | 1985 | 1984 | 1983 | 1982 | 1981 | 1980 | 19      |
|------------------------------|------|------|------|-------|-------|------|------|------|------|------|------|------|---------|
| 1990                         | 4.00 |      |      |       |       |      |      |      |      |      |      |      |         |
| 1989                         | 0.44 | 3.00 |      |       |       |      |      |      |      |      |      |      |         |
| 1988                         | 1.52 | 0.59 | 3.04 |       |       |      |      |      |      |      |      |      |         |
| 1987                         | 1.06 | 2.48 | 0.75 | 3.42  |       |      |      |      |      |      |      |      |         |
| 1986                         |      | 1.32 | 3.95 | 3.06  | 6.88  |      |      |      |      |      |      |      |         |
| 1985                         |      |      | 0.94 | 2.81  | 2.38  | 2.17 |      |      |      |      |      |      |         |
| 1984                         |      |      |      | 0.61  | 2.92  | 2.59 | 4.13 |      |      |      |      |      |         |
| 1983                         |      |      |      |       | 0.89  | 1.83 | 0.86 | 0.70 |      |      |      |      |         |
| 1982                         |      |      |      |       |       | 0.72 | 1.86 | 1.17 | 1.51 |      |      |      |         |
| 1981                         |      |      |      |       |       |      | 2.53 | 1.89 | 1.91 | 4.53 |      |      |         |
| 1980                         |      |      |      |       |       |      |      | 0.80 | 2.25 | 2.36 | 2.43 |      |         |
| 1979                         |      |      |      |       |       |      |      |      | 0.81 | 1.38 | 1.75 | 1.86 |         |
| 1978                         |      |      |      |       |       |      |      |      |      | 0.93 | 1.71 | 1.68 | 1 _____ |
| 1977                         |      |      |      |       |       |      |      |      |      |      | 1.06 | 1.95 | 2 _____ |
| 1976                         |      |      |      |       |       |      |      |      |      |      |      | 1.06 | 1 _____ |
| 1975                         |      |      |      |       |       |      |      |      |      |      |      |      | 0 _____ |
| Total                        | 7.02 | 7.39 | 8.68 | 10.9  | 13.07 | 7.31 | 9.37 | 4.56 | 6.48 | 9.20 | 6.94 | 6.55 | 6 _____ |
| Nu/ha                        | 728  | 766  | 900  | 1,123 | 1,353 | 757  | 970  | 472  | 671  | 953  | 719  | 678  | 61.--   |

<sup>a</sup> Year eggs were deposited.

Table 9. Annual survival rates (percent) for various age classes of kokanee in Coeur d'Alene, Idaho, 1979-1991.

| Year of estimate   | Egg to fall fry | Age 0 to Age 1 | Age 1 to Age 2 | Age 2 to Age 3 |
|--------------------|-----------------|----------------|----------------|----------------|
| 1991               | 1.96            | 15             | 258            | 43             |
| 1990               | 1.94            | 19             | 330            | 32             |
| 1989               | 2.55            | 22             | 129            | 33             |
| 1988               | 2.71            | 44             | 118            | 21             |
| 1987               | 6.68            | 109            | 113            | 49             |
| 1986               | 1.29            | 62             | 213            | 39             |
| 1985               | 3.90            | 123            | 159            | 134            |
| 1984               | 0.71            | 77             | 99             | 36             |
| 1983               | 1.25            | 42             | 95             | 59             |
| 1982               | 2.46            | 97             | 79             | 54             |
| 1981               | 1.45            | 94             | 102            | 54             |
| 1980               | 2.20            | 112            | 85             | 59             |
| 1979               | 1.7             | --             | --             | --             |
| Mean               | 2.4             | 71.0           | 119.0          | 43             |
| Standard deviation | +/- 1.6         | +/- 40         | +/- 40         | +/- 12         |



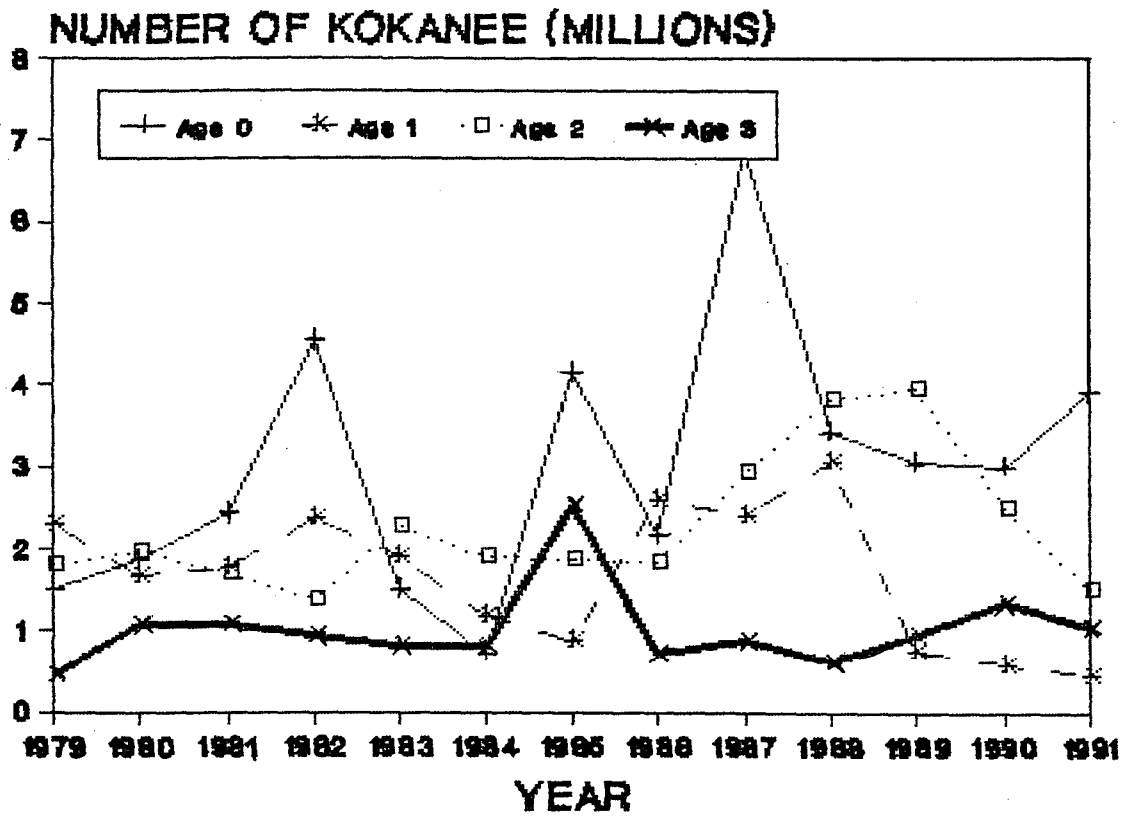


Figure 6. Abundance of kokanee by age group from Coeur d'Alene Lake, 1979-1991.

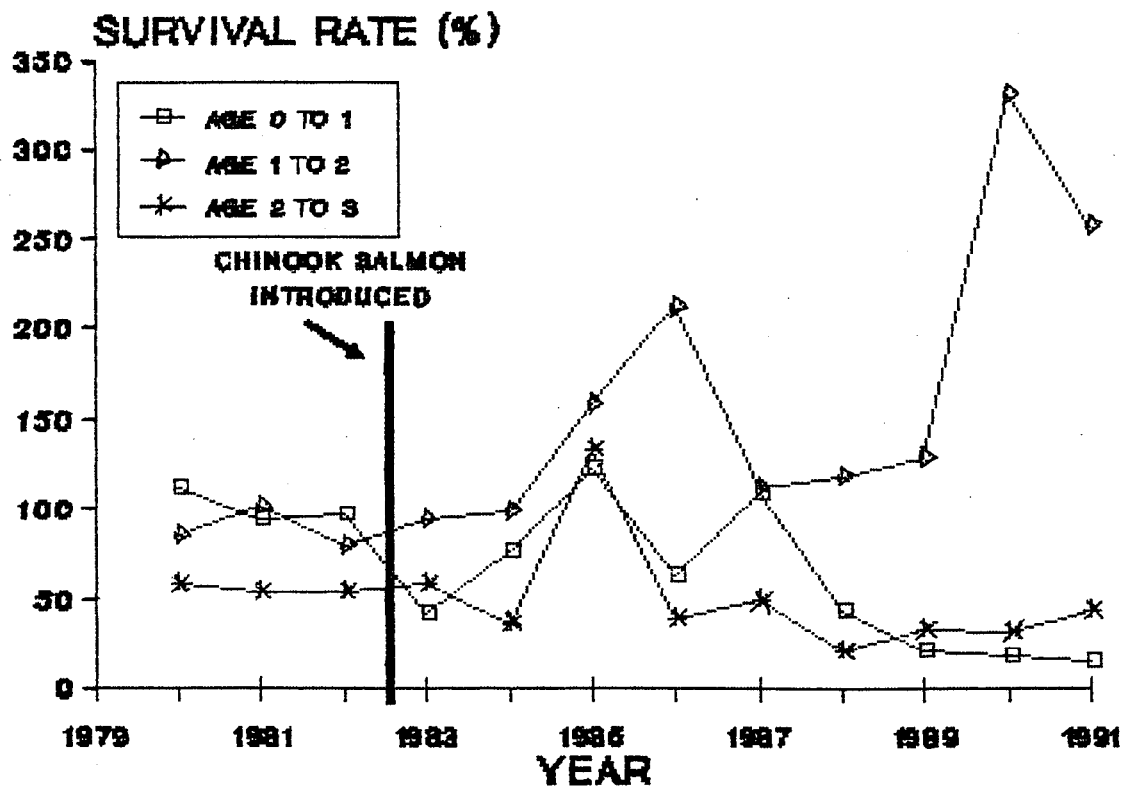


Figure 7. Survival rate for kokanee from Coeur d'Alene Lake, 1979-1991.

year class (Table 10). The stocking rates of hatchery chinook salmon have been augmented by natural reproduction. The 1986 year class produced a total of 97,278 age 0 chinook salmon (hatchery and natural) or a density of 9.6 fish/ha that entered Coeur d'Alene Lake.

In 1991, the age 2 kokanee abundance estimate was 1.52 million fish. If age 2 to age 3 kokanee survival remains the same, 43% in 1992, then the estimated density of age 3 kokanee would be 72 fish/ha, within the desired range, 60 to 90 fish/ha. We need to stabilize the kokanee population at its present level. We have reduced the 1992 age 0 chinook salmon stocking to 10,000 fish and we have reduced the 1992 natural chinook salmon production by destroying 8 of the 13 redds in the Coeur d'Alene River. However, we may see a continued decline in the kokanee population as the 1990 and 1991 kokanee year classes mature because of the overabundance of chinook salmon already in the system.

The high density of chinook salmon has appeared to change the behavior of age 1 kokanee. Abundance of age 1 kokanee estimated by trawling have steadily declined since 1989 (Table 8). However, age 1 to age 2 kokanee survival rates appeared to be in excess of 200%. A similar age 2 to age 3 survival rate occurred in 1986 (Table 9) three years after we stocked 60,100 age 0 chinook. In years when age 0 chinook were less than 60,000, age 1 to age 2 kokanee survival was still about 100%. The most likely reason for the apparent survival rate was that the trawl was missing age 1 kokanee. Or, age 2 kokanee were fully recruited to the trawling gear and age 1 kokanee were not. The abundance of age 2 kokanee may be the best indicator of chinook salmon predation, although no relationship has been found as yet.

As mentioned earlier, natural chinook salmon production must be controlled to maintain the balance between chinook salmon and kokanee. Moving the Wolf Lodge Creek weir to its present location has eliminated the best spawning habitat in Wolf Lodge Creek. The estimated number of age 0 natural chinook salmon has decreased. However, I observed chinook salmon spawning below the weir. Eggs were deposited on large rip-rap in slow moving water. Relocation of the weir further downstream would be extremely difficult. We may have to accept some natural reproduction in Wolf Lodge Creek.

A weir was constructed in the Coeur d'Alene River to block and trap the upstream migrating chinook salmon and prevent spawning. In 1990, very few salmon were trapped (23), and 40 redds were constructed below the weir. In 1991, the weir was relocated further downstream. Again, very few fish were trapped (29), and there were 12 redds below the weir. The 1991 spawning run up the Coeur d'Alene River was smaller than the 1990 run; 59 and 175 adult chinook salmon, respectively. In 1992, the weir will be moved downstream to the last location before the water becomes too deep for this type of weir to be effective. If spawning occurs we may have to accept some natural reproduction in the Coeur d'Alene River or use a different type of weir that operates in deeper water.

There appears to be a difference in age at maturity between natural chinook salmon and hatchery reared chinook salmon. Most of the natural chinook salmon mature at age 2, 40%, and age 3, 60% (Table 11). Whereas, hatchery reared fish matured at 50:50 age 2 to age 3. The exception was the 1987 year class of hatchery fish in which 78% of the fish trapped were age 3 and 22% were age 2. It was unclear what caused this change in maturity of hatchery reared fish.

## **RECOMMENDATIONS**

1. Stock 10,000 chinook salmon into Coeur d'Alene Lake to allow the kokanee population to stabilize at a density of 60 to 90 age 3 kokanee per hectare.

Table 10. Number of hatchery and naturally produced chinook salmon in the wolf Lodge Creek spawning run, tributary to Coeur d'Alene Lake, Idaho. (Year class denotes the year eggs were laid. Estimate of Age 0 natural chinook was derived by the proportion of hatchery to natural fish.)

| Year Class | Hatchery Release Date | Hatchery Release Number | Hatchery |       |       | Natural |       |       | Estimated Age 0 natural chinook salmon produced | Estimated Total Age 0 produced |
|------------|-----------------------|-------------------------|----------|-------|-------|---------|-------|-------|---|--------------------------------|
|            |                       |                         | Age 2    | Age 3 | Age 4 | Age 2   | Age 3 | Age 4 |   |                                |
| 1981       | 1982                  | 34,400                  |          |       | --    |         |       | --    | 0   | 34,400                         |
| 1982       | 1983                  | 60,100                  |          |       |       |         |       |       | 0   | 60,100                         |
| 1983       | 1984                  | 10,500                  |          |       |       |         |       |       | 0   | 10,500                         |
| 1984       | 1985                  | 18,500                  |          |       |       |         |       |       | 13,500  | 32,000                         |
| 1985       | 1986                  | 29,500                  | 18       | 17    | --    | 16      | 28    |       | 37,086  | 64,581                         |
| 1986       | 1987                  | 59,406                  | 64       | 59    | 7     | 25      | 54    | 9     | 37,878  | 97,278                         |
| 1987       | 1988                  | 44,600                  | 28       | 101   | --    | 19      | 42    |       | 21,569  | 66,169                         |
| 1988       | 1989                  | 35,400                  | 105      | --    | --    | 32      |       |       | ?   |                                |
| 1989       | 1990                  | 36,350                  | --       |       |       |         |       |       | ?   |                                |
| 1990       | 1991                  | 42,650                  | --       |       |       |         |       |       | ?   |                                |
| 1991       | 1992                  | 1,000                   | --       | --    | --    |         |       |       | N/A   |                                |

Table II. Age of maturity for hatchery and natural chinook salmon year classes trapped in Wolf Lodge Creek, Coeur d'Alene Lake, Idaho. 1985-1988 (year trapped).

| Year Class | Hatchery |          |       |          |       |         | Natural |          |       |          |       |          |
|------------|----------|----------|-------|----------|-------|---------|---------|----------|-------|----------|-------|----------|
|            | Age 2    |          | Age 3 |          | Age 4 |         | Age 2   |          | Age 3 |          | Age 4 |          |
|            | No.      | %        | No.   | %        | No.   | %       | No.     | %        | No.   | %        | No.   | %        |
| 1985       | 18       | 51(1988) | 17    | 49(1989) | 0     | --      | 16      | 36(1988) | 28    | 64(1989) | 0     | --       |
| 1986       | 64       | 49(1989) | 59    | 45(1990) | 7     | 5(1991) | 25      | 28(1989) | 54    | 61(1990) | 9     | 10(1991) |
| 1987       | 28       | 22(1990) | 101   | 78(1991) | --    | --      | 19      | 31(1990) | 42    | 69(1991) | --    | --       |
| 1988       | 105      | --(1991) | --    | --       | --    | --      | 32+     | 0(1991)  | --    | --       | --    | --       |

2. Evaluate chinook salmon egg survival in the Coeur d'Alene River.
3. Control natural reproduction in the Coeur d'Alene River.
4. Assess kokanee population dynamics through midwater trawling.
5. Educate the public to the limits of kokanee production and chinook salmon production in Coeur d'Alene Lake.
6. Determine the number of adult chinook salmon in the spawning runs in Wolf Lodge Creek and the Coeur d'Alene River.
7. Relocate the Coeur d'Alene River weir downstream from the 1991 location to prevent successful spawning.

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## JOB PERFORMANCE REPORT

State of: Idaho Name: Regional Fishery Management  
Investigations

Project No.: F-71-R-16 Title: Region 1 River and Streams  
Investigations

Job No.: 1-c<sup>1</sup>

Period Covered: July 1, 1991 to June 30, 1992

### ABSTRACT

Stream temperatures were found to be limiting for salmonids during the late summer and early fall in the lower Priest River. From July 15 to September 12, 1991, 50% of the temperature readings taken at the outlet of Priest Lake exceeded 21°C. This trend was maintained throughout the length of the stream to its confluence with the Pend Oreille River. River discharge during this period ranged from a high of 1,420 cubic feet per second (cfs) on July 20 to a low of 194 cfs on September 12. A tagging study of hatchery rainbow trout Oncorhynchus mykiss, stocked at Dickensheet Campground and McAbee Falls, showed a return to the creel of 4%. All of the tag returns were from fish stocked at McAbee Falls and were caught by anglers at McAbee Falls.

Twenty Whitlock vibert boxes charged with brown trout Salmo trutta eggs were buried in artificial redds in Hoodoo Creek on December 20, 1991. Retrieval of these boxes on March 28, 1992 indicated limited hatching success. The majority of the boxes acted as a silt trap, smothering the eggs in a fine organic mud. The few boxes that escaped the silt evidenced a hatching success in excess of 85%.

Kokanee salmon Oncorhynchus nerka kennerlyi spawning ground counts in tributaries of the Kootenai River revealed the lowest number of returning spawners since 1983. Only 11 kokanee salmon were observed in the four index stream surveyed.

The St. Joe River was surveyed for potential smallmouth bass Micropterus dolomieu introduction. The river appeared to have adequate habitat but lacked water temperatures conducive to smallmouth bass survival. There was a strong possibility that smallmouth would prey heavily on native westslope cutthroat trout O. clarki lewisi. Therefore, smallmouth bass was recommended for introduction into the St. Joe River.

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SEC1-C1



## OBJECTIVES

1. To determine if summer stream temperatures are a limiting factor for salmonids in the lower Priest River.
2. To assess the survival of brown trout Salmo trutta eggs hatched in vibert boxes in Hoodoo Creek.
3. Determine potential impacts of introduction of smallmouth bass Micropterus dolomieu on cutthroat trout Oncorhynchus clarki and kokanee O. nerka kennerlyi.
4. Predict success of providing a smallmouth bass fishery in the St. Joe and St. Maries rivers.

## PRIEST RIVER

The lower Priest River flows approximately 80 km from Priest Lake south to the Pend Oreille River (Figure 1). Discharges from Priest Lake are regulated by a dam at the outlet to maintain the lake 0.9 m (three feet) above the ordinary low water mark to provide stable lake levels during the recreation season (June to October). This lake level management is mandated by section 70-507 of the Idaho Code, initiated in 1950, with the construction of the original wood crib dam. In 1980, the wood crib dam was replaced with a concrete structure. Idaho Code also requires a minimum stream flow during the period of flow restriction to provide no less than 60 cfs at the U.S. Geological Survey "Dickensheet" gauge. The minimum flow is less than the natural mean low flow during the summer and fall.

The Spirit Priest Basin Association (SPBA) citizen advisory group requested a study be conducted to evaluate operation of the outlet structure to provide a combination of benefits relative to river flows, lake levels, and power production. Their concern was that low summer flows and elevated water temperatures in the lower Priest River result in impaired fisheries habitat and reduce fishing opportunities. Evaluation of the put-and-take rainbow trout O. mykiss fishery (documented in this report and Horner 1987) indicates the majority of the fishing pressure occurs at McAbee Falls on the lower Priest River. Public access along the majority of the lower Priest River's length is extremely limited.

Another study, directed at the physical attributes of the stream channel, was conducted during the restricted flow period utilizing Instream Flow Incremental Methodology (Robertson, in progress). A second study was initiated to assess the temperature regime of the lower Priest River during the summer and early fall. Volunteer efforts by SPBA members provided river temperature information at ten locations between Priest Lake and the confluence of Priest River with the Pend Oreille River.

## Methods

Volunteers were provided with pocket thermometers and directed to take water temperatures at designated sites every two to three days. Ten sample sites (Figure 2) were chosen to represent the lower Priest River from Outlet Bay to the town of Priest River, Idaho, and monitor the influence of tributary streams; Outlet dam, Binarch Creek, Dickensheet Campground, Upper West Branch, East River, Big Creek, McAbee Falls, Blue Creek, Lower West Branch, and just upstream of the

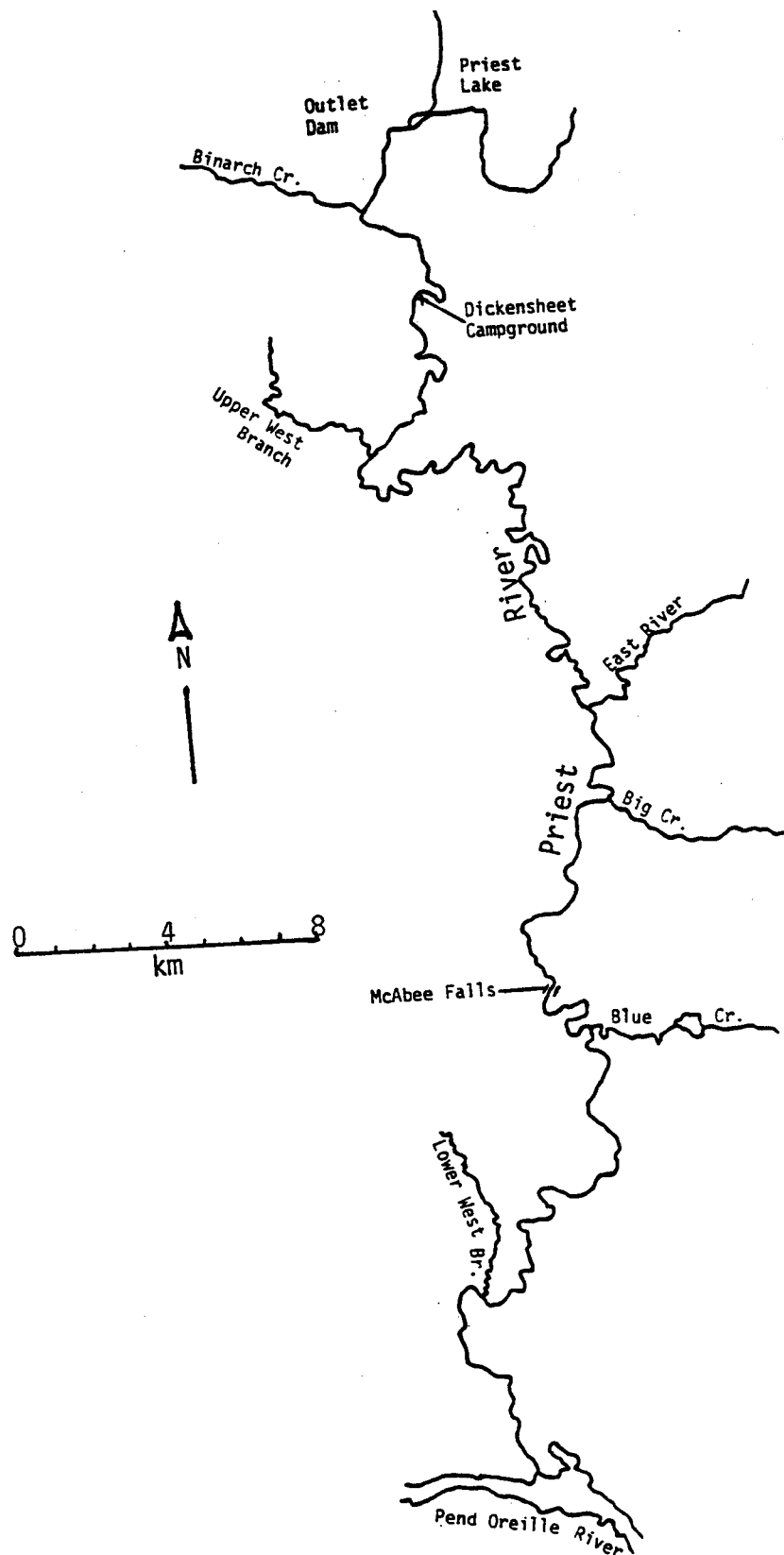


Figure 1. Map of Priest River, Idaho.

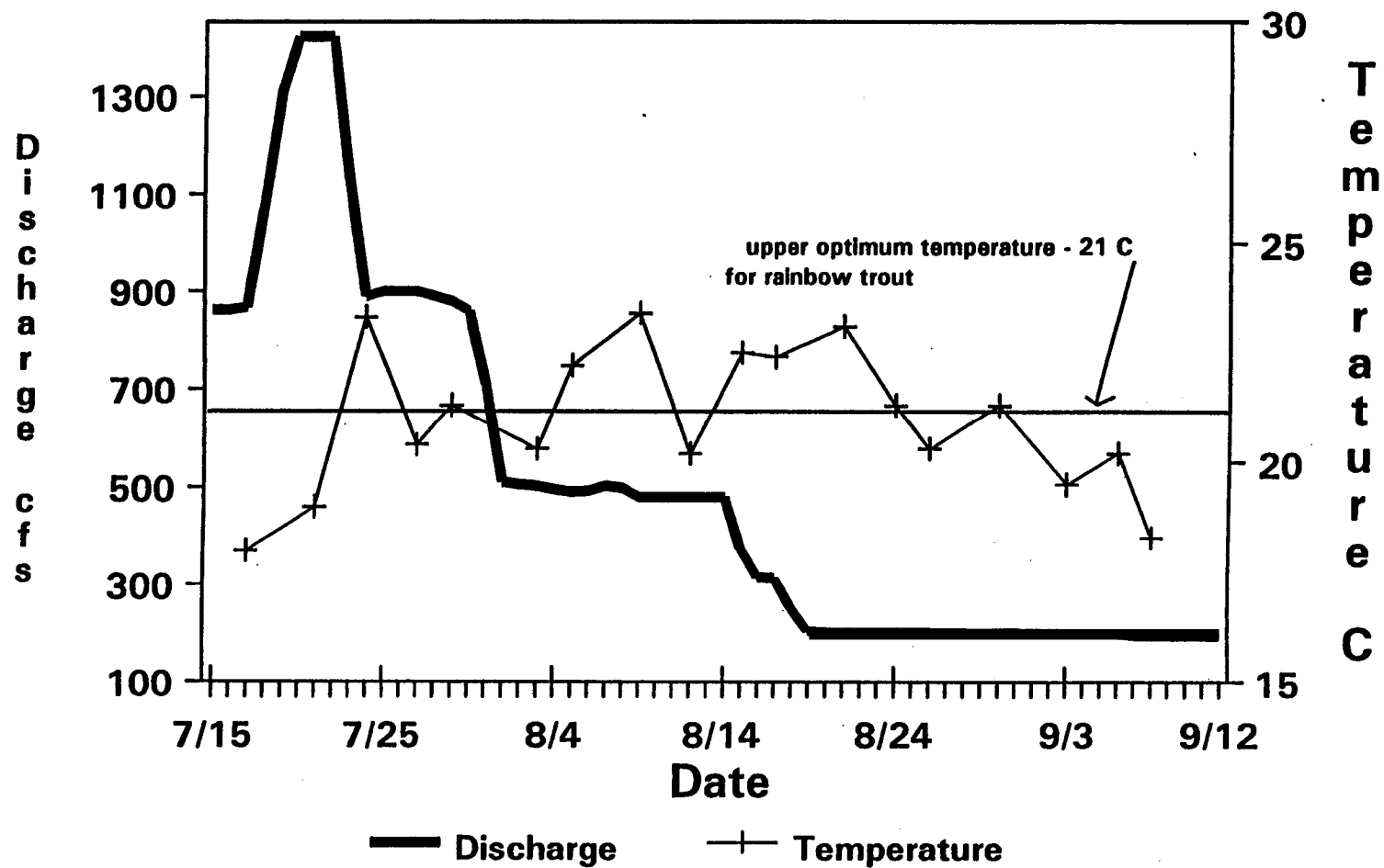


Figure 2. Discharge as measured at Dickensheet Campground, Priest River (station no. 123940000), July 15 through September 12, 1991 and stream temperature as recorded in Priest Lake upstream from Outlet Dam.

confluence of the Priest River with the Pend Oreille River at the town of Priest River. Where sample sites were located at the mouth of tributary streams, water temperatures were taken upstream and downstream from the mouth of the tributary. In addition, weather condition and time of day was recorded.

## **Results and Discussion**

During the temperature study period (July 15 through September 12, 1991), river flows measured at the Dickensheet Campground, USGS gauge station number 12394000, ranged from 1,420 cfs to 194 cfs (Figure 2). Water temperature in Outlet Bay (upstream from Outlet Dam) exceeded 21°C 9 times out of the 18 readings taken (Figure 2). Only two of the tributary streams, Binarch Creek and Upper West Branch, maintained temperatures significantly lower such that they had an influence on the main river. In both cases, the temperature reduction and tributary stream flow was not great enough to effect the lower Priest River once mixing occurred. While some fluctuation was noted at the various sites (Figures 3-6), overall the river temperature, throughout the season along the entire stream length, appears to be influenced greatly by the temperature of the water leaving Priest Lake. Water temperatures in the lower Priest River approached or exceeded the upper limit of the optimum temperature range of rainbow trout, 21°C, (Carlander 1969) from mid-July through late August.

The average monthly stream discharges in the lower Priest River during the study period in 1991 were, June = 3,665 cfs, July = 1,420 cfs, August = 347 cfs, and September = 222 cfs. These flows were very near the previous ten-year averages of 3,180.7 cfs for June, 951.2 for July, 336.8 for August, and 229.5 for September (Table 1).

Review of historic literature indicates that fishing in the lower Priest River, prior to the mid-1950s, was best during and immediately after the spring runoff, and that after July 15 fishing was quite poor (Bjornn 1957). It was speculated that the fishery was supported by fish migrating to and from the lake for reproductive purposes, and that fishing was poor after July 15 because the stream temperature was becoming too warm and the fish migrated from the river. This observation may indicate that the recruitment to the fishery was dependant on the tributary streams to provide a sanctuary for fish during periods of high temperature. Past land management practices have greatly degraded the quality of the tributary streams such that they can no longer provide this sanctuary, either because of increased temperatures or loss of holding habitat.

Summer water temperatures in lower Priest River are now dependant on the temperature of the water leaving Priest Lake. The only possible way to provide cooler water temperatures for salmonids in lower Priest River would be to construct an elaborate syphon system to bring deep cold water from beneath the epilimnion of Priest Lake. How far downstream this cold water would cool the river is unknown, but it is unlikely to substantially change river temperatures given the minimum flow conditions imposed by the mandated lake level management.

During July 1991, 1,200 put-and-take rainbow trout were stocked in the lower Priest River at Dickensheet Campground (600 fish) and at McAbee Falls (600 fish). One hundred of these fish (50 fish per site) received \$5 reward Floy tags to assess the return to the creel of the hatchery program. Four tags were returned in 1991. All four tagged fish were from the McAbee Falls stockings, and all four were caught by anglers at McAbee Falls. Return to the creel equaled 4%. The Dickensheet Campground stocking site offers no holding water for fish after they are planted. These fish are washed downstream providing very limited return to the creel. Because of limited public access sites and fish stocking sites, it appears that a reduced stocking of several hundred fish at McAbee Falls will provide the best return for the angler dollar. Future stocking of hatchery put-

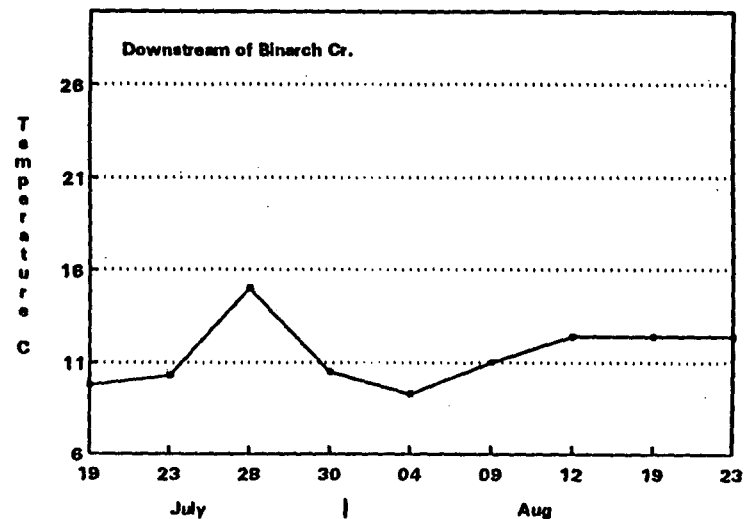
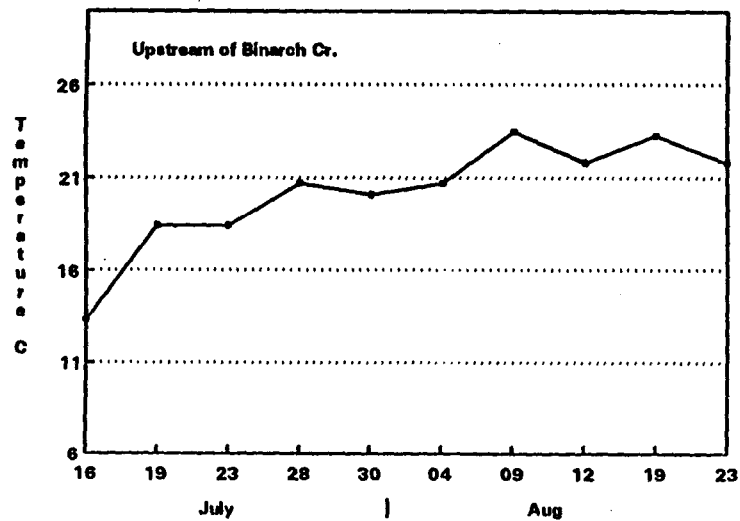
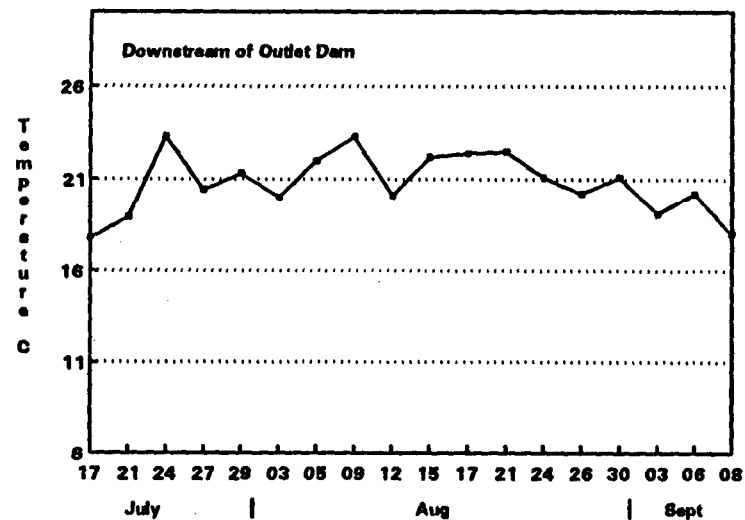
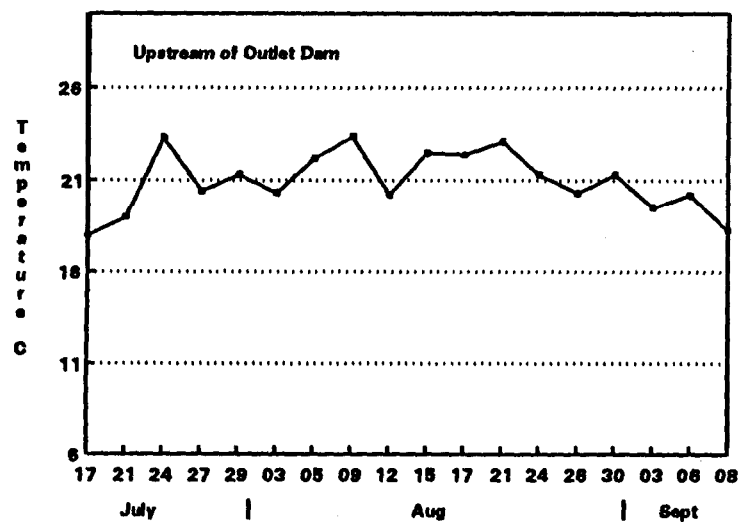


Figure 3. Priest River stream temperatures, July through September 1991, as recorded upstream from Outlet Dam, downstream from Outlet Dam, upstream from Binarch Creek, and downstream from Binarch Creek.

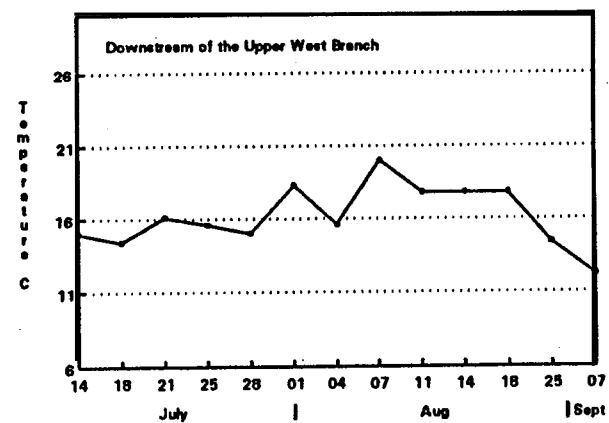
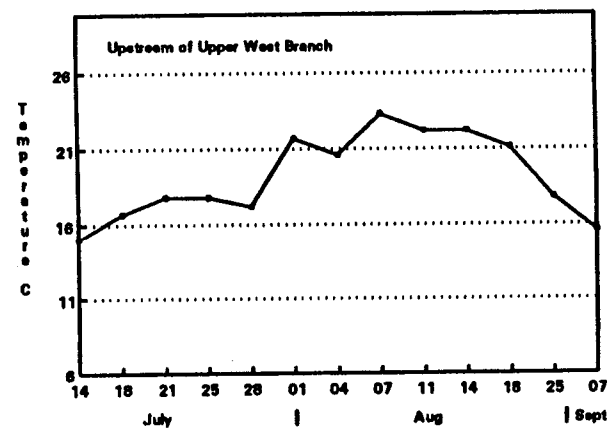
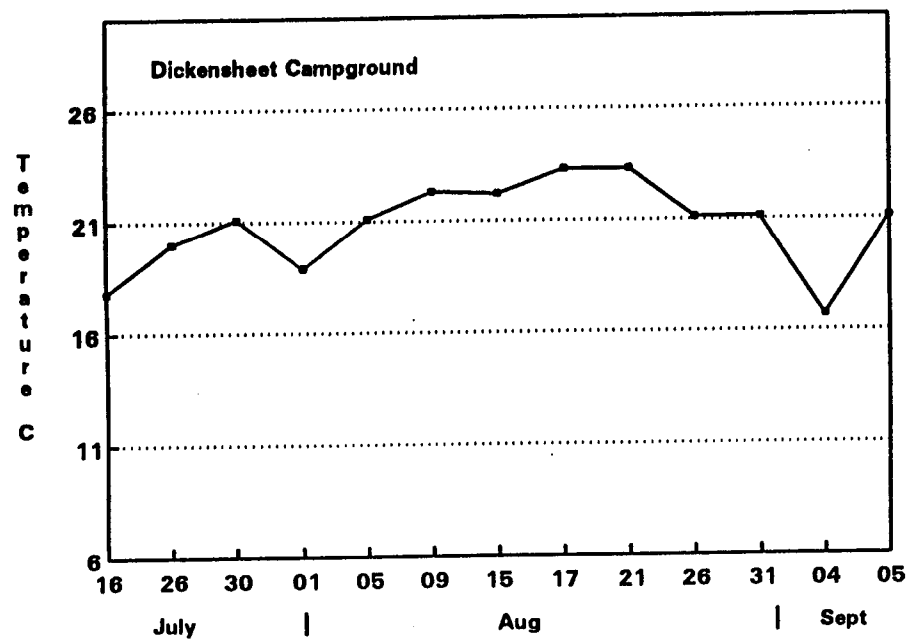


Figure 4. Priest River stream temperatures, July through September 1991, as recorded at Dickensheet Campground, upstream from the Upper West Branch, and downstream from the Upper West Branch.

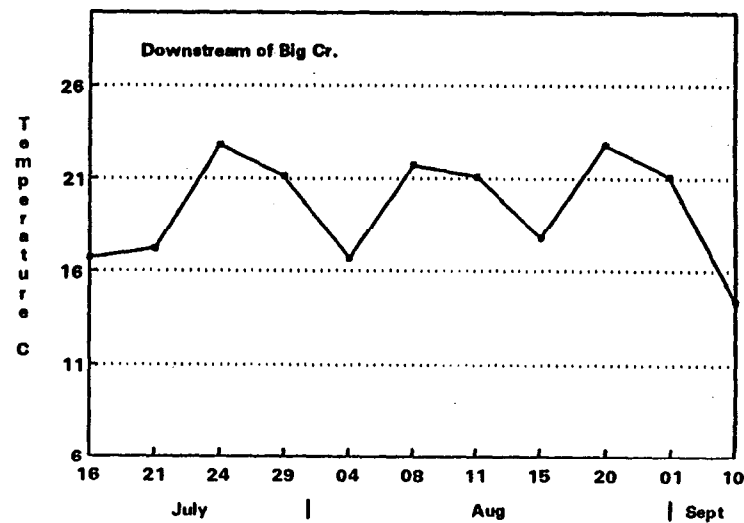
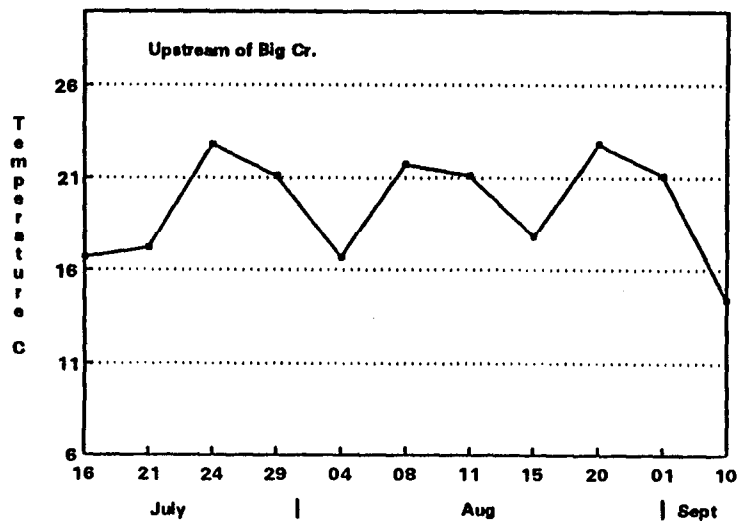
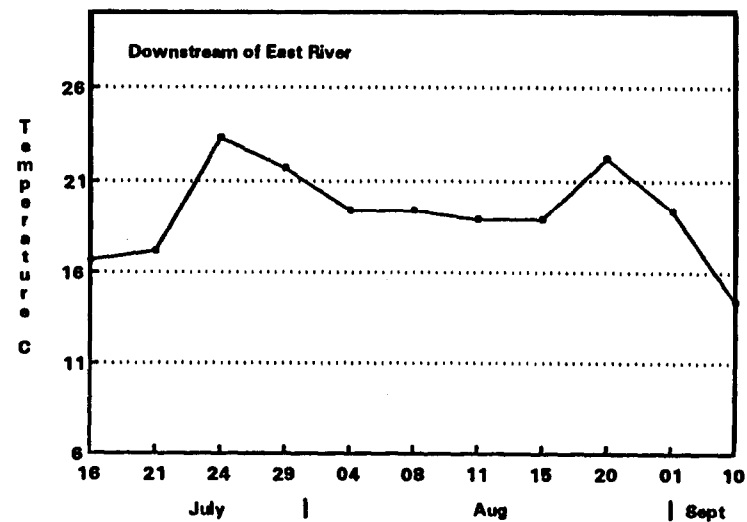
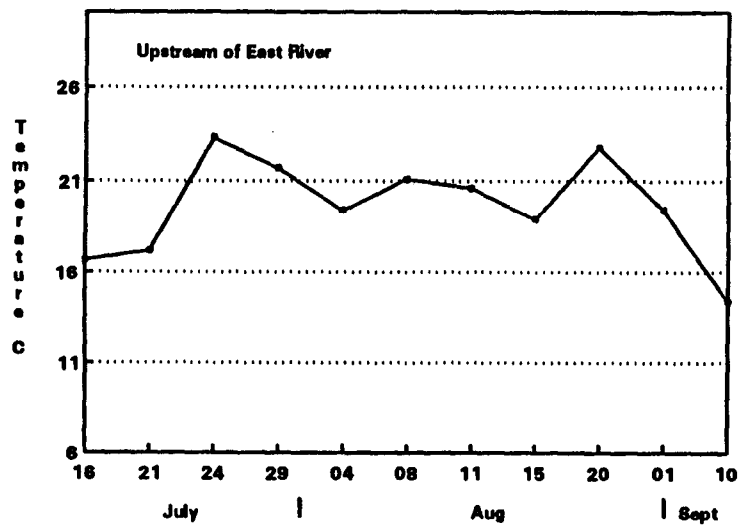


Figure 5. Priest River stream temperatures, July through September 1991, as recorded upstream from the East River, downstream from the East River, upstream from Big Creek, and downstream from Big Creek.

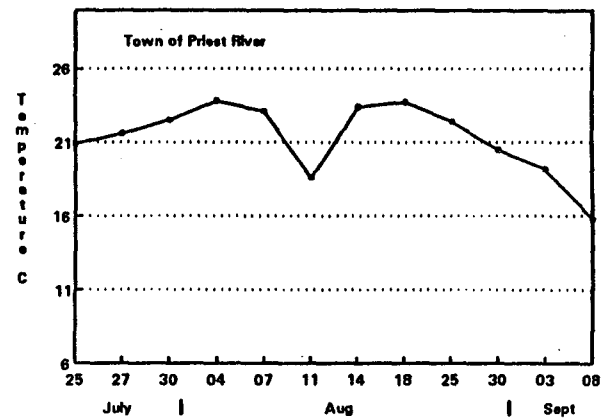
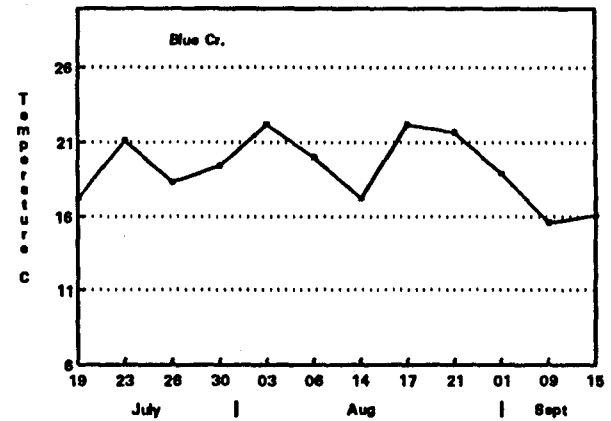
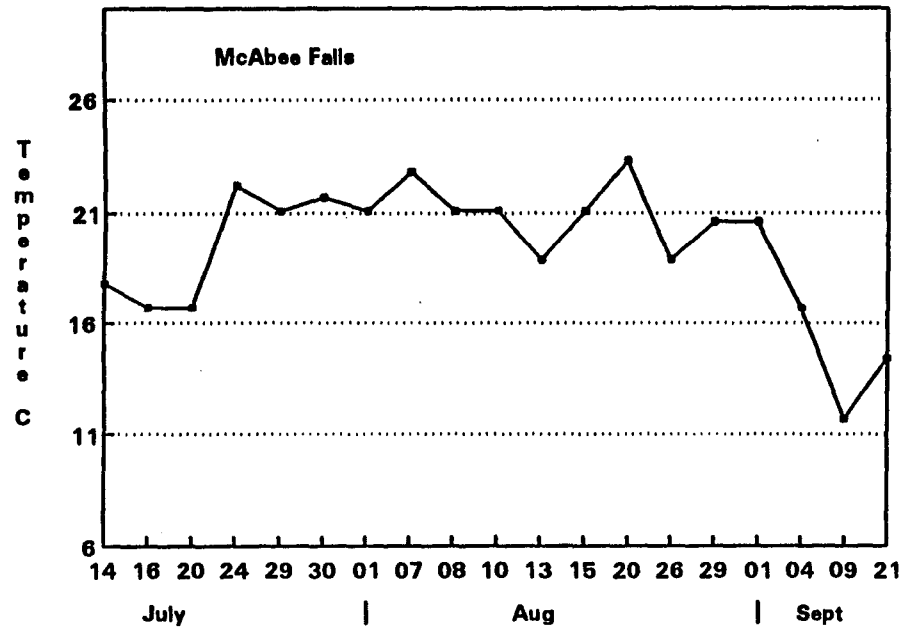


Figure 6. Priest River stream temperatures, July through September 1991, as recorded at McAbee Falls, Blue Creek, and at the town of Priest River upstream from the confluence of Priest River and the Pend Oreille River.



Table 1. Mean monthly stream discharge (cfs) for the Lower Priest River, June through September, 1981-1991, as measured at the USGS gauge (station no. 12394000) located at Dickensheet Campground.

| Year | June  | July  | August | September |
|------|-------|-------|--------|-----------|
| 1981 | 3,381 | 1,580 | 509    | 282       |
| 1982 | 5,068 | 1,573 | 420    | 414       |
| 1983 | 4,488 | 1,777 | 727    | 342       |
| 1984 | 4,814 | 1,247 | 312    | 158       |
| 1985 | 2,433 | 239   | 208    | 335       |
| 1986 | 1,906 | 646   | 162    | 205       |
| 1987 | 1,271 | 434   | 233    | 90        |
| 1988 | 1,667 | 370   | 116    | 78        |
| 1989 | 1,945 | 502   | 384    | 194       |
| 1990 | 4,834 | 1,144 | 297    | 197       |
| 1991 | 3,665 | 1,420 | 347    | 222       |

and-take rainbow trout in lower Priest River will be limited to the McAbee Falls site.

Alternative fisheries should be explored which would provide the public with fishing opportunity on the lower Priest River. Smallmouth bass may be one option. In 1992, a habitat survey and literature review will be conducted to assess the viability of the lower Priest River to support a self-sustaining smallmouth bass population.

## HOODOO CREEK

Hoodoo Creek is a low gradient spring-fed stream that originates close to Kelso Lake and flows approximately 22 km west and north to the Pend Oreille River (Figure 7). Due to past land management practices such as grazing of livestock and the dredging and straitening of Hoodoo Creek by the Corp of Engineers to drain surrounding agriculture land, Hoodoo Creek is heavily impacted by silt. Currently there is only one major source of livestock impact, a dairy farm located approximately 1.5 km southwest of the town of Vay, Idaho. Historically, grazing activity affected a significant portion of Hoodoo Creek, and the stream still shows the effects. Riparian vegetation is lacking along the majority of stream reach. High summertime stream temperatures, nutrient loading, and the lack of scouring spring runoff have encouraged the prolific growth of aquatic vegetation. This aquatic growth has added to the imbedded nature of the stream bottom as it dies and decomposes.

Electrofishing efforts in Hoodoo Creek in 1983 (Horner 1984) yielded rainbow trout, cutthroat trout, rainbow/cutthroat hybrids, brook trout Salvelinus fontinalis, and brown trout ranging from 50 mm to 410 mm. Other species included mountain whitefish Prosopium williamsoni, largescale sucker Catostomus macrocheilus, longnose dace Rhinichthys cataractae, yellow perch Perca flavescens, tench Tinca tinca, and slimy sculpin Cottus cognatus. Brown trout have been stocked in Hoodoo Creek in the past. Current fish densities in Hoodoo Creek are unknown. There is some evidence that brown trout and rainbow trout spawn in the lower kilometer of Hoodoo Creek with limited success. The stream offers little other spawning substrate, and the brown trout population is maintained primarily by stocking fingerlings.

In 1991, the North Idaho Fly Caster Club (NIFCC) requested the assistance if Idaho Fish and Game to hatch brown trout eggs in vibert boxes in an effort to enhance brown trout recruitment in Hoodoo Creek.

## Methods

Twenty Whitlock vibert boxes, charged with approximately 500 brown trout eggs each, were obtained from the Harriman Trout Company, St. Ignatius, Montana, on December 20, 1991. The following day, Idaho Fish and Game employees and members of the NIFCC buried the boxes in Hoodoo Creek at predetermined sites on Ron Winship's property, located approximately 1.5 kilometers upstream from the Pend Oreille River (Figure 7). Artificial redds were constructed by digging up the gravel and sifting it through 3/8 inch hardware cloth to remove the fines. The vibert boxes were submerged in 2% iodine solution to disinfect the eggs, and were then placed in the depression created by the removal of the gravels and covered with the cleaned gravel. Redd locations were marked with wood lath and colored flagging to assist in locating the sites at a later date for removal. Eight redds were constructed in which one to four vibert boxes were placed. Redd #8 contained a single vibert box which was to be sacrificed after the eggs had hatched and prior to fry emergence to assess hatching success.

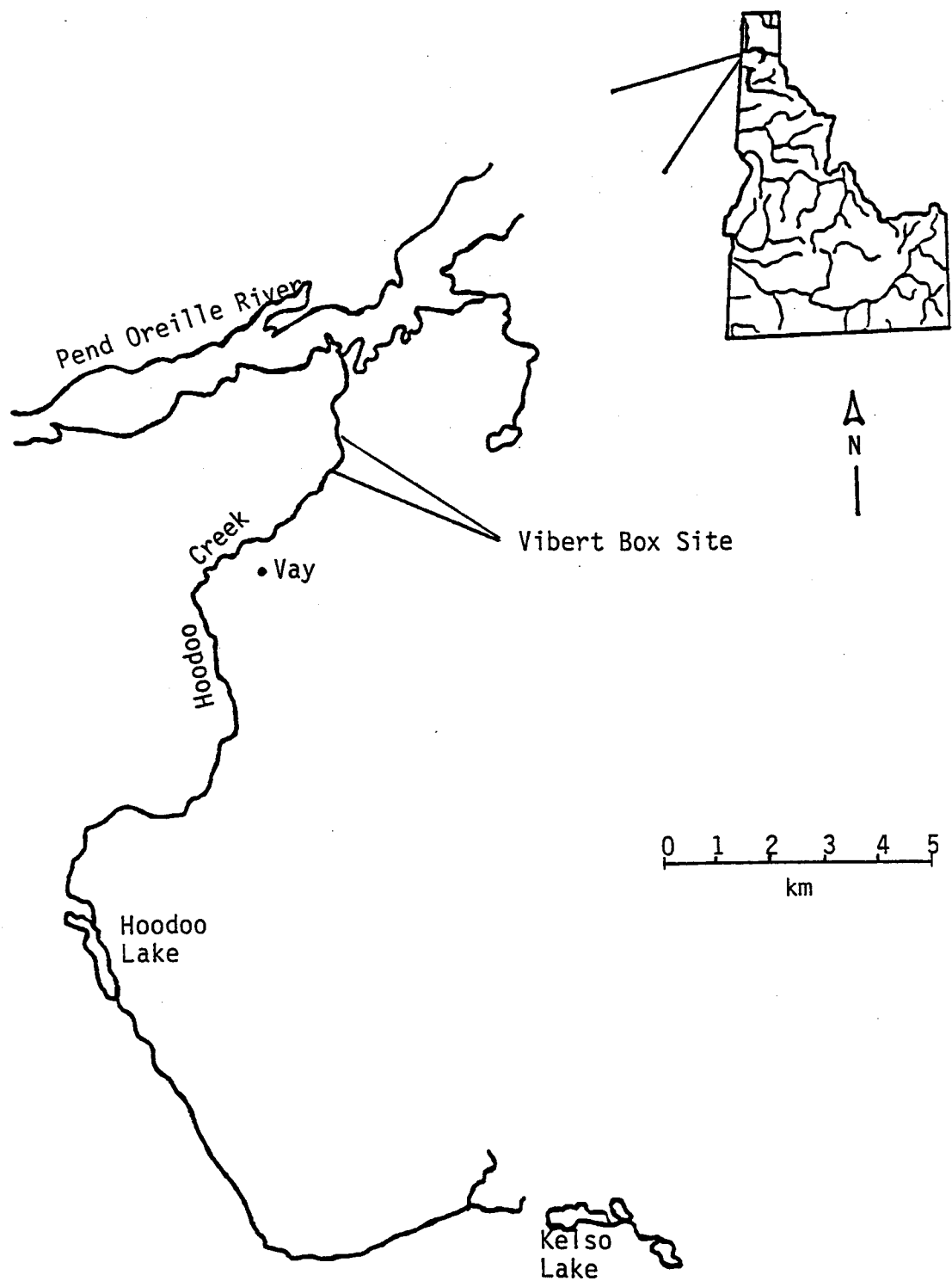


Figure 7. Location of vibert box sites on Hoodoo Creek, 1991.

## Results and Discussion

Redd #8 was excavated February 8, 1992 to retrieve the vibert box and assess the hatching success of the brown trout eggs. The vibert box was packed with an organic silt, nearly filling both the upper and lower chambers. Sifting through the silt, 11 sac fry were found alive, with all of the remaining eggs being dead. We estimated the 11 fry found alive were only one to two days old and would not have survived much longer in the vibert box with the amount of silt present. The remaining 19 vibert boxes were removed March 28, 1992. The hatching success of these boxes was estimated by the presence or absence of a coagulated egg mass in the upper egg chamber of the boxes. The results were inconstant between boxes and not apparently related to the placement of the box.

Even with a 40% survival to hatch, the vibert box, in a system such as Hoodoo Creek, is not a viable alternative to fingerling stocking. The most beneficial activity for Hoodoo Creek at this time would be to enhance the riparian habitat along the stream course. It is suggested that in cooperation with the Soil Conservation Service, local land owners, and sportsmen organizations, a program be developed to promote the revegetation and fencing, where needed, of Hoodoo Creek to enhance the fishery habitat available and reduce the degree of siltation in the system. Once banks are stable and siltation is significantly reduced, it may be possible to provide spawning areas by adding gravel to selected areas of the stream.

## Kootenai River

Kokanee salmon spawning in tributaries to the Kootenai River in Idaho are from early spawning stocks from the South Arm of Kootenay Lake, British Columbia. This stock has nearly collapsed in Kootenay Lake, and in an effort to save the last remnants of the run, Idaho tributaries were closed to the harvest of kokanee in 1982. Estimates of the number of kokanee present in the primary Idaho spawning tributaries have been made during a one-day count in mid-August to early September since 1983.

Counts of kokanee adults in the four index streams in 1991 revealed the lowest number of kokanee ever counted (Table 2). If the downward trend continues, this stock of kokanee will likely be lost in the very near future. The closure on harvest will continue in hopes of offering some opportunity for recovery.

## **SMALLMOUTH BASS HABITAT EVALUATION**

### St. Maries and St. Joe Rivers

The lower portions of the St. Maries and St. Joe rivers near the town of St. Maries, Idaho, were seasonally inundated by the construction of Post Falls Dam in 1906. The fluctuation in Coeur d'Alene Lake was up to 2.1 m annually. The change from lotic to lentic habitat created more backwater areas which are needed for rearing by juvenile squawfish *Ptychocheilus oregonensis*. Local anglers reported a change in the fishery from predominantly westslope cutthroat trout *O. clarki lewisi* to squawfish beginning in the early summer in the lower portions of the St. Joe and St. Maries rivers. Generally, local anglers have

Table 2. Estimates of spawning kokanee salmon in tributaries to the Kootenai River, 1983-1991.

| Stream      | 1983 <sup>a</sup> | 1984 <sup>b</sup> | 1985 <sup>c</sup> | 1986 <sup>d</sup> | 1987 <sup>e</sup> | 1988 <sup>e</sup> | 1989 <sup>`</sup> | 1990 <sup>e</sup> | 1991 <sup>b</sup> |
|-------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Boundary    | 10                | 55                | 200               | 10                | 0                 | 0                 | 30                | 4                 | 1                 |
| Long Canyon | 300               | 17                | 650               | 400               | 0                 | 0                 | 0                 | 0                 | 0                 |
| Parker      | 100               | 70                | 75                | 10                | 6                 | 0                 | 0                 | 0                 | 0                 |
| Smith       | 150               | 130               | 1,500+            | 400               | 350               | 200+              | 75                | 40                | 10                |

<sup>a</sup> Counts made on August 15.

<sup>b</sup> Counts made on August 31.

<sup>c</sup> Counts made on September 6.

<sup>d</sup> Counts made on September 4.

<sup>e</sup> Counts made on September 1.

become dissatisfied with the fishing opportunities near the town of St. Maries, Idaho.

Several species of fish have been stocked in an attempt to provide desirable fisheries in the St. Maries and St. Joe rivers. A put-and-take fishery using rainbow trout began before 1964. Tiger muskie Esox lucius x E. masquinongy were introduced in 1989 and 1990. Channel catfish Ictalurus punctatus were stocked from 1989 to 1991. Neither stocking has resulted in creation of a successful fishery to date.

Smallmouth bass, a non-endemic species, has been considered for introduction. Smallmouth bass may help to reduce the abundant sucker Catostomus sp. and squawfish population and shift fish biomass to a desirable sport fishery for bass. Negative tradeoffs include increased predation on juvenile adfluvial westslope cutthroat trout and young-of-the-year (YOY) kokanee in Coeur d'Alene Lake. Another major consideration is whether a desirable fishery can be created in the slackwater portion of the St. Maries and St. Joe rivers without negatively impacting desirable sport fisheries in Coeur d'Alene Lake and other connecting waters.

## METHODS

A YSI Model 58 temperature/oxygen meter was used to determine oxygen and temperature profiles in the St. Joe River. Profiles were made 1 km below and 1 km above the confluence of the St. Maries River (Figure 8). Visual observations were made to estimate linear shoreline of suitable smallmouth bass habitat. The length of rocky shores, submerged trees, and overhead vegetation were estimated. These measurements were performed on June 18, 1991 when snowmelt runoff created low water temperatures. Water temperatures are critical for smallmouth bass spawning, growth, and survival of YOY bass.

## RESULTS AND DISCUSSION

A total of 22 km of the St. Joe River were surveyed beginning at the Forest Service Campground 'Shadowy St. Joe' working downstream one kilometer past the confluence of the St. Maries River. We observed rocky shores, vegetation, and submerged logs along 4.6 km of the right (northern) bank and 2.6 km of the left (southern) bank that provided desirable smallmouth bass habitat.

The maximum channel depth was 11m. Paragamian (1976) reported the highest standing crop of smallmouth bass were found in pools greater than 1.4 m deep. Smallmouth bass avoided depths less than 0.5 m (Bennett and Bennett 1991). Water velocity in the St. Joe River was measured to be 0.3 m/s, which was within the range reported by Hubert and Lackey (1980). The gradient in the St. Joe River near St. Maries is 0.0020 which is below the optimum range of 0.08-0.47% (Paragamian 1979, Edward et al. 1983).

The two most critical factors reported in the literature that limit smallmouth bass abundance and growth were water temperature and turbidity. Water temperature was the most significant.

Water temperature is the most critical limiting factor to smallmouth bass distribution (Robbins and MacCrimmon, 1974). Carlander (1977) reported smallmouth bass were usually found in streams in the southern portion of their range and in lakes in the northern portion. Smallmouth bass spawning occurs when water temperatures are between 13°C and 21°C (Newell 1960). In the St. Joe River on June 18, 1991, the water temperature was 10°C. Maximum temperature of 19°C was

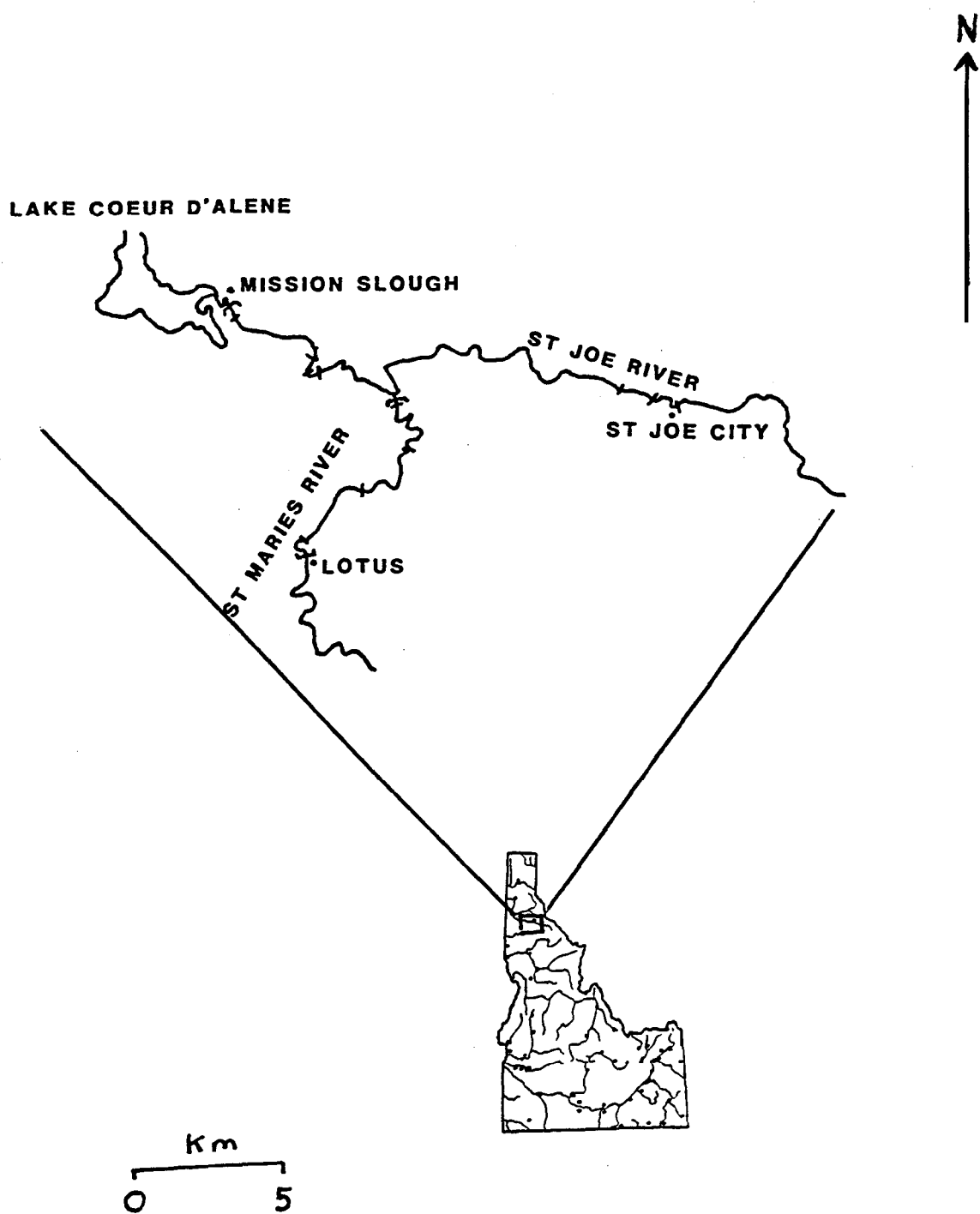


Figure 8. Location of St. Maries River, Idaho.

reached in August (USGS Gauging station data), and minimum spawning temperature was reached about June 15 (USGS Gauging station data). Although minimum spawning temperature was reached in June, the river never reached the preferred temperature of 20°C to 21°C (Ferguson 1958) and there was not enough growing season at the optimum temperature to assure adequate growth for smallmouth bass YOY to survive the winter. Shuter et al. (1980) reported that YOY bass must attain a minimum length of 50 mm to survive the winter, and increased length increased survival.

In the Clearwater River, smallmouth bass were eliminated below the confluence of the North Fork Clearwater River because the maximum water temperature decreased from 25°C to 15°C (Al Van Vooren, IDFG, personal communication). Smallmouth bass are present in Clover Creek, a tributary to the Snake River, where maximum water was 21°C in late August, but optimum water temperature was reached on May 10 providing three full months of growing season.

There is a strong population of smallmouth bass in the Snake River. Average water temperatures in the Snake River below Hell's Canyon Dam between 1985-1990 reached 13°C by June 1. The optimum temperatures were maintained from July through September and did not drop below 13°C until October (Chris Randolph, Idaho Water Power, personal communication). In 1990, water temperatures reached 13°C in April.

In the St. Joe River, smallmouth bass would probably emigrate to more desirable conditions because of the relatively low water temperature. If they remained, growth would be very slow, and successful natural reproduction would be limited to low water years when water temperatures reached optimum range in May or early June.

Edward et al. (1983) reported turbidity in excess of 30 JTU's would be detrimental to smallmouth bass. Secchi disk reading of 3 m below the confluence of the St. Maries River and 4.5 m above the confluence indicated turbidity should not be a problem. However, the St. Maries River does have periods of very high turbidity that may affect smallmouth bass.

Predation by smallmouth bass on salmonid species, mainly westslope cutthroat trout, is a potential negative factor to the introduction of smallmouth bass. Bennett and Bennett (1991) summarized the available literature on salmonid/bass interactions. Based on this summary, predation on cutthroat in the St. Joe River and Coeur d'Alene Lake would be minimal. However, researchers found that in the Columbia River during the anadromous smolt migration period, 50% of the smallmouth bass diet was salmonid smolts. Lukens (1978) reported westslope cutthroat trout migrated from Wolf Lodge Creek into Coeur d'Alene Lake at 110-190 mm, which is the ideal prey size for adult smallmouth bass. In the St. Joe River, juvenile cutthroat trout would be vulnerable to smallmouth bass predation because both species associate with the littoral area. Therefore, it is my opinion that smallmouth bass would prey heavily on migrating westslope cutthroat trout in the St. Joe River and in Coeur d'Alene Lake and that they should not be introduced into the St. Joe River.

Smallmouth bass have been observed in Coeur d'Alene Lake and will provide an opportunity to determine the extent of predation on cutthroat trout and kokanee. Predation on kokanee salmon would occur in May and June as kokanee fry emerge and smallmouth bass are moving into shallower, warmer areas of the lake. However, Hassemer (1984) reported the kokanee fry in Coeur d'Alene Lake become pelagic immediately upon emergence and therefore predation would be minimal. Even though smallmouth bass are present in Coeur d'Alene Lake, I believe we should not expand their population into other areas in the system.



## RECOMMENDATIONS

1. Limit stocking of hatchery put-and-take rainbow in the lower Priest River to the McAbee Falls site.
2. Evaluate the lower Priest River for introduction of smallmouth bass.
3. Work with landowners and sportsmen groups to improve riparian habitat along Hoodoo Creek.
4. Do not stock smallmouth bass into the St. Joe or St. Maries rivers because of the predation on westslope cutthroat trout that would occur.
5. Continue to evaluate new species of game fish that have the potential to produce a desirable fishery in the St. Joe and St. Maries rivers.
6. Investigate smallmouth bass population in Coeur d'Alene Lake.

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## JOB PERFORMANCE REPORT

State of: Idaho Name: Regional Fishery Management  
Investigations  
Project No.: F-71-R-16 Title: Region 1 Rivers and Streams  
Investigations-Hatchery Trout  
Job No.: 1-c<sup>2</sup> Evaluation  
Period Cover: July 1, 1991 to June 30, 1992

### ABSTRACT

Percent return to the creel of put and take rainbow trout Oncorhynchus mykiss in 1991 was 6.6% and 8.7% for the North Fork Coeur d'Alene River and the Little North Fork Coeur d'Alene River, respectively. Return rate for rainbow stocked in Priest River was very low, 1% in 1991.

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## INTRODUCTION

Put-and-take trout fisheries are the most expensive hatchery program undertaken by the Idaho Department of Fish and Game (IDFG). The statewide fishery management plan for the 1991-1995 period calls for the increased emphasis on wild trout management and more efficient use of hatchery fish.

The general management direction for put-and-take trout stocking programs is to increase return rates by concentrating releases of fish in easily accessible, heavily fished waters, stock fish during the peak periods of fishing pressure, publicize stocking locations, improve holding water where possible, and produce a high quality hatchery product. Bodies of water that do not return 40% by number or 100% by weight of stocked hatchery fish may be eliminated from the stocking program. Stocking in streams is being closely scrutinized because return rates are usually low and emphasis is to manage streams for wild trout whenever possible.

Fishery managers must evaluate the return rates for waters that receive hatchery put-and-take trout. The Coeur d'Alene River system is stocked with nearly 20,000 put-and-take rainbow trout *Oncorhynchus mykiss* during late May to late August. In 1991, the North Fork Coeur d'Alene River (NFCAR), the Little North Fork Coeur d'Alene River (LNFCAR), and the Priest River were selected for evaluation of put-and-take hatchery trout stocking.

## OBJECTIVES

1. Determine the percent return to the creel for put-and-take rainbow trout.
2. Recommend strategies to improve return of put-and-take trout.

## DESCRIPTION OF STUDY AREA

The stocking locations on the LNFCAR were limited to 11 sites in a 6.4 km reach between Bumblebee Campground and mile marker 7 on Forest Service Road 209 (Figure 1). There were 22 stocking sites in two areas on the NFCAR totaling 24 km of stocked water (Figure 1). The first 12 sites began at the mouth of the LNFCAR upstream to the Maple Cliff area. The second 10 stocking sites were located between Venus Creek and Devils Elbow Campground (Figure 1).

Only two stocking locations were available on Priest River, Dickensheet Campground, and McAbee Falls (Figure 2).

## METHODS

A total of 900 put-and-take trout were tagged with \$5.00 yellow reward Floy tags in 1991. Each river was to receive a total of 300 tagged fish stocked throughout the summer, May to August. The tag number and length (mm) was recorded for each tagged fish.

Put and take trout for the NFCAR and LNFCAR were kept at Mullan Hatchery. Each month 100 fish were tagged for each river and kept in separate raceways, and these fish were stocked on a weekly basis. Approximately 25 tagged fish were stocked in each river each week. The stocking date and location was recorded for most of the tagged trout.

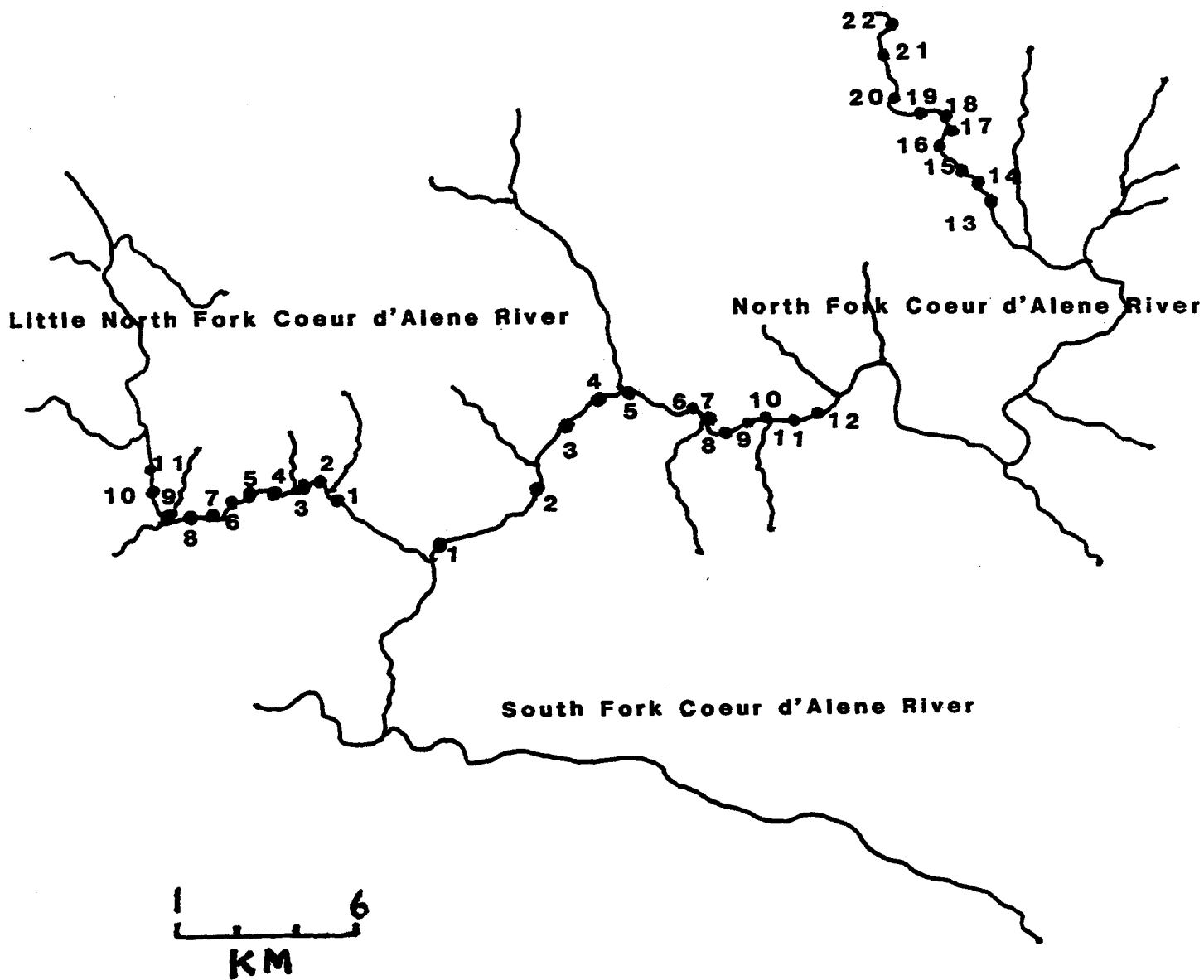


Figure 1. Map of the stocking locations for put-and-take rainbow trout in the North Fork Coeur d'Alene and Little North Fork Coeur d'Alene rivers, 1991.

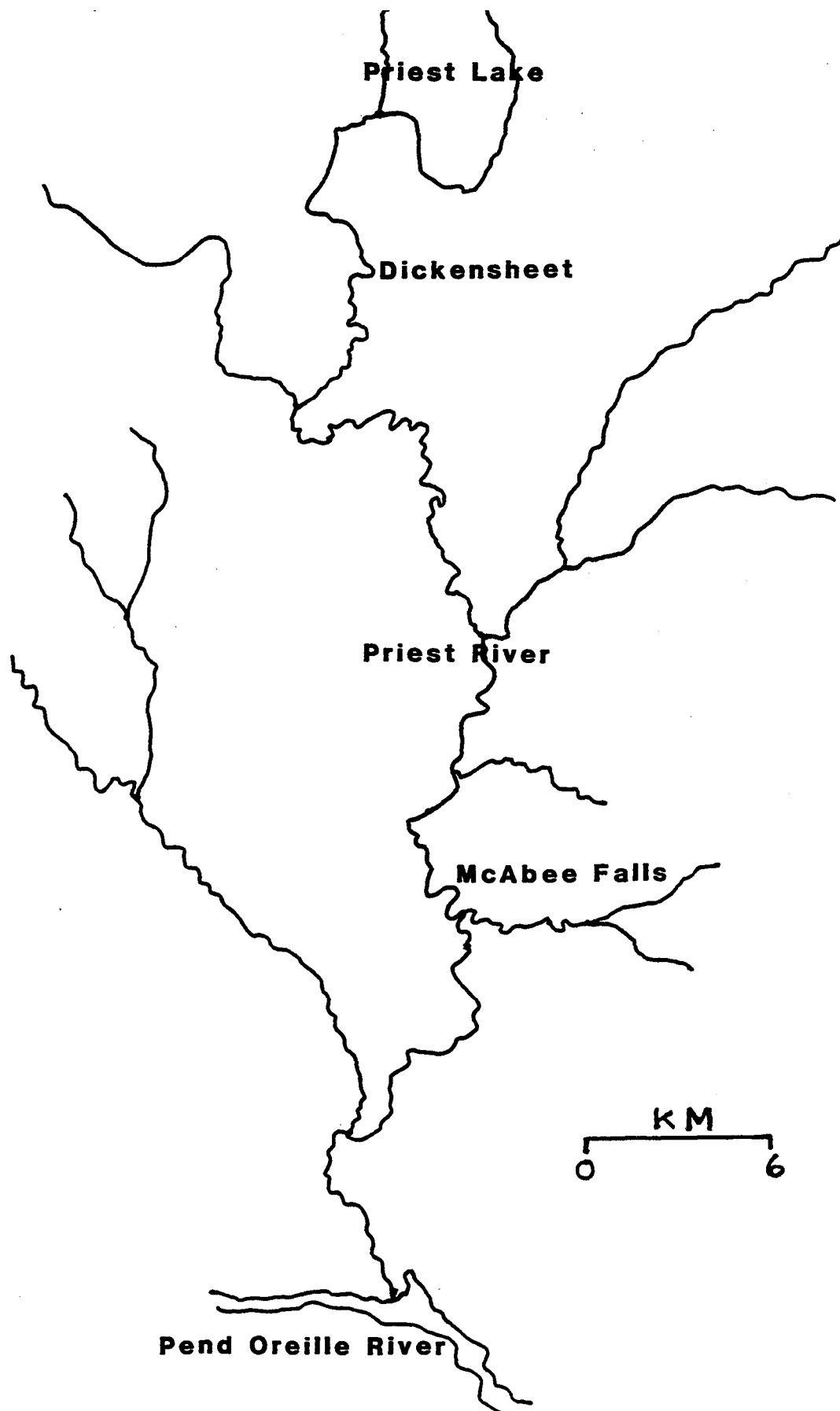


Figure 2. Map of the stocking locations for put-and-take rainbow trout in the Priest River, 1991.

In Priest River, the put-and-take trout were stocked twice in July. A total of 1,200 rainbow trout were stocked and 100 fish were tagged.

## RESULTS

The percent return of the tagged put-and-take trout in the NFCDAR and LNFCDAAR were 6.6% and 8.7%, respectively (Table 1). The highest number of tag returns occurred in July for both rivers. Table 1 lists the number of tagged trout stocked at each site and the number of tagged trout caught and returned.

Return rates were influenced by the length of the tagged fish. In the LNFCDAAR, 26% of the rainbow trout stocked were less than 230 mm (9 in) and comprised only 5% of the returned tags. Fish over 230 mm comprised 74% of the tagged trout and 95% of the returned tags. Return to the creel for fish over 230 mm was 9%. Rainbow trout over 230 mm comprised 75% of the tagged fish in the NFCDAR and 100% of the returned tags. Return to the creel was 10% for fish over 230 mm. The number of fish tagged and returned from each stocking site was listed in Table 2. There was some movement of tagged trout; most of the trout stayed on site or moved downstream (Table 3).

In Priest River, only 4 of the 100 tagged fish were returned. The exploitation rate was 4%.

## DISCUSSION

The return of tagged rainbow trout to the creel was extremely low in 1991; 6.6% and 8.7% in the NFCDAR and LNFCDAAR, respectively. The low return rates may have resulted from a combination of several factors; poor survival (adaptability) of rainbow trout strain stocked, poor habitat at the stocking site, emigration from the area, low fishing pressure, predation, and failure to report tags.

Management reports from the mid-1980s indicated return rates were twice as high. Horner and Rieman(1985) and Horner et al. (1986) reported tag return rates of 14% and 10% for the NFCDAR and LNFCDAAR, respectively. Return rates may have been influenced by changes in stocking strategies. Since 1985 the number of stocking sites were reduced, stocking frequency was increased, and total number of fish stocked was reduced. The frequency of stocking was increased from once a month to once a week. The number of put-and-take rainbow trout stocked was reduced from 15,475 in 1985 to 10,134 in 1991 in the NFCDAR and from 6,008 to 3,047 in the LNFCDAAR. The total number of river kilometers stocked in the NFCDAR was reduced from 54 km in 1985 to 24 km in 1991. In the LNFCDAAR, the length of river stocked was reduced from 14 in 1985 to 6.4 km in 1991. Although the total number of fish stocked was reduced between 1985 and 1991, the density of fish stocked increased from 287 fish/km in 1985 to 422 fish/km in 1991 in the NFCDAR. In the LNFCDAAR, density increased from 316 fish/km in 1985 to 476 fish/km in 1991.

Reported return rates of stocked fish in other Idaho waters were much higher than in the NFCDAR and LNFCDAAR; 25% for the Big Lost River (Elle et al. 1987), 32% for the Middle Fork Boise River (B. Rohrer, IDFG, personal communication), 48% for the Big Wood River (Thurrow 1988), 81% for the Boise River (Reid and Mabbott 1987), 20% to 34% for the Lochsa River (Lindland and Pettit 1981; Lindland 1982), and 25% for the Salmon River(Lukens and Davis 1989).

Return to the creel can be improved by stocking larger fish. The 1991 return rates indicated that fish over 230 mm (9 in) were the only fish that returned in the NFCDAR and 95% of the creeled fish in the LNFCDAAR. Similar results occurred on the Lochsa and Selway rivers (E. Schriever, IDFG, personal communication).

Table 1. Percent return to the creel for \$5.00 reward Floy-tagged put-and-take rainbow trout from the North Fork Coeur d'Alene and Little North Fork Coeur d'Alene rivers, 1991.

| Tag number                      | Date tagged | Number tagged | Number returned | Percent returned | Number returned per month |      |      |        |           |
|---------------------------------|-------------|---------------|-----------------|------------------|---------------------------|------|------|--------|-----------|
|                                 |             |               |                 |                  | May                       | June | July | August | September |
| North Fork Coeur d'Alene        |             |               |                 |                  |                           |      |      |        |           |
| 15601-15700                     | May/June    | 100           | 10              | 10               | 0                         | 4    | 4    | 2      | 0         |
| 15701-15800                     | July        | 100           | 8               | 8                | 0                         | 0    | 5    | 3      | 0         |
| 15801-15900                     | August      | 86            | 1               | 1.2              | 0                         | 0    | 0    | 0      | 1         |
| Total                           |             | 286           | 19              | 6.6              | 0                         | 4    | 9    | 5      | 1         |
| Little North Fork Coeur d'Alene |             |               |                 |                  |                           |      |      |        |           |
| 15901-16000                     | May/June    | 99            | 19              | 19               | 0                         | 5    | 9    | 5      | 0         |
| 16001-16100                     | July        | 99            | 4               | 4                | 0                         | 0    | 3    | 1      | 0         |
| 16100-16200                     | August      | 89            | 2               | 2.2              | 0                         | 0    | 2    | 0      | 0         |
| Total                           |             | 287           | 25              | 8.7              | 0                         | 5    | 14   | 6      | 0         |



Table 2. Stocking location, number of \$5.00 reward Flay tagged put-and-take rainbow trout stocked, and number of tags returned from each set in the North Fork Coeur d'Alene River and the Little North Fork Coeur d'Alene River, 1991.

| Stocking site | North Fork Coeur d'Alene River |                 |                  | Little North Fork Coeur d'Alene River |                 |                  |
|---------------|--------------------------------|-----------------|------------------|---------------------------------------|-----------------|------------------|
|               | Number tagged                  | Number returned | Percent returned | Number tagged                         | Number returned | Percent returned |
| 1             | 28                             | 1               | 3.6              | 37                                    | 1               | 2.7              |
| 2             | 19                             | 0               | 0                | 30                                    | 6               | 20.0             |
| 3             | 12                             | 1               | 8.3              | 20                                    | 2               | 10.0             |
| 4             | 13                             | 1               | 7.7              | 35                                    | 4               | 11.4             |
| 5             | 22                             | 1               | 4.5              | 24                                    | 0               | 0                |
| 6             | 12                             | 2               | 16.7             | 10                                    | 0               | 0                |
| 7             | 4                              | 0               | 0                | 27                                    | 2               | 7.4              |
| 8             | 25                             | 2               | 7.4              | 3                                     | 0               | 0                |
| 9             | 4                              | 0               | 0                | 14                                    | 1               | 7.1              |
| 10            | 9                              | 1               | 11.1             | 36                                    | 4               | 11.1             |
| 11            | 11                             | 1               | 9.1              | 17                                    | 1               | 5.9              |
| 12            | 19                             | 3               | 15.8             |                                       |                 |                  |
| 13            | 4                              | 0               | 0                |                                       |                 |                  |
| 14            | 14                             | 0               | 0                |                                       |                 |                  |
| 15            | 9                              | 0               | 0                |                                       |                 |                  |
| 16            | 9                              | 0               | 0                |                                       |                 |                  |
| 17            | 21                             | 2               | 9.5              |                                       |                 |                  |
| 18            | 16                             | 2               | 12.5             |                                       |                 |                  |
| 19            | 12                             | 0               | 0                |                                       |                 |                  |
| 20            | 10                             | 2               | 20.0             |                                       |                 |                  |
| 21            | 9                              | 0               | 0                |                                       |                 |                  |
| 22            | 16                             | 1               | 6.3              |                                       |                 |                  |

Table 3. Movement of tagged put-and-take rainbow trout in the North Fork Coeur d'Alene River and Little North Fork Coeur d'Alene River, 1991.

| Direction<br>of<br>movement | North Fork Coeur d'Alene River |        | Little North Fork Coeur d'Alene River |        |
|-----------------------------|--------------------------------|--------|---------------------------------------|--------|
|                             | Percent                        | Number | Percent                               | Number |
| Upstream                    | 16                             | 3      | 9.0                                   | 2      |
| Downstream                  | 42                             | 8      | 50.0                                  | 11     |
| Same                        | 42                             | 8      | 41.0                                  | 9      |

Reallocation of the monthly allotment of rainbow trout stocked may be another method to improve returns. Most of the tag returns came from the July harvest. Increasing the June and July allotments and reducing the May and August allotments would provide more fish during the period of higher return rates.

Several factors need more detailed investigation to determine why the return rates were low; fishing pressure and fish harvested, habitat at the stocking site, survival of the stocked fish, movement, strain of fish stocked, and length of fish stocked.

If returns cannot be improved to a desirable level, a change in management of the fishery would be necessary. One option for the Coeur d'Alene River system would be to classify it as a "wild trout river" and rely on natural reproduction to sustain the fishery. However, low trout density, due to poor quality habitat in the tributaries, may result in an unacceptable fishery to the angler. Catch and release regulations would be needed to manage for wild trout. However, the public may not support this type of management.

The 4% return rate in 1991 in Priest River was higher than the 3% return reported by Horner and Rieman (1985). High river flows in 1991 delayed the stocking until July, two months later than requested, and may have caused the lower return rate. The two tagging studies have shown that rainbow trout stocked into the Priest River provide very low return rates, therefore the existing stocking program should be discontinued. An alternative body of water should be located or developed to replace the Priest River fishery.

#### **RECOMMENDATIONS**

1. Develop an informational brochure to increase angler awareness of where put-and-take trout are stocked.
2. Evaluate survival of trout stocked, persistence of the fish in the river fishery, and fish habitat at the stocking sites.
3. Conduct creel surveys during selected periods to evaluate angler effort and harvest.
4. Fish stocked into the Coeur d'Alene River system should be a minimum of 250 mm to evaluate the effects of length of fish on return rates.
5. Discontinue stocking at the Dickensheet access area in the Priest River. Continue to stock the McAbee Falls site but at a much reduced rate. Identify additional locations that would provide acceptable returns of catchable trout.

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## JOB PERFORMANCE REPORT

State of: Idaho Name: Regional Fisheries Management  
Investigations

Project No: F-71-R-16 Title: Region 1 Rivers and Streams  
Investigations -Habitat  
Evaluation and Trout Density  
Estimates for Six Tributaries to  
the Little North Fork  
Clearwater River, Idaho, 1991

Job No: 1-c<sup>3</sup>

Period Covered: July 1, 1991 to June 30, 1992

### ABSTRACT

The percentage of pool habitat in Adair, Rutledge, Twin, Montana, Spotted Louis, and Buck creeks ranged from 2% to 10%. There was a 79% reduction in residual pool volume between Buck Creek, an unmanaged drainage, and the other five managed drainages.

Trout density estimates ranged from 4 to 21 fish/100 m<sup>2</sup>. Pool habitat contained the highest number of fish.

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## INTRODUCTION

This study evaluated stream habitat, channel stability, and trout densities in relation to logging activities. Six tributaries in the upper Little North Fork Clearwater River drainage were selected for evaluation based on the different number of acres logged within each drainage. The tributaries included Adair, Rutledge, Twin, Montana, Spotted Louis, and Buck creeks (Figures 1 and 2). Since 1970, logging has occurred in 43% of Twin Creek and Rutledge Creek drainages, 37% of Montana Creek drainage, 22% of Adair Creek drainage, 9% of Spotted Louis Creek drainage, and 0% of the Buck Creek.

In 1991, a 2- to 3-year logging project began in the headwaters of Buck Creek. The habitat evaluation and trout density estimates will establish a baseline for future evaluations in Buck Creek.

## OBJECTIVES

1. Assess macro habitat quantity and quality in six tributaries of the Little North Fork Clearwater River.
2. Estimate trout densities in six tributaries of the Little North Fork Clearwater River.

## DESCRIPTION OF STUDY AREA

Adair Creek was approximately 4.3 km long, drained 2,090 ha (6,798 acres), and the stream gradient was 4% in the reach surveyed. Sand comprised the major component of the stream substrate. Very little timber remained in the riparian zone for stream shading and recruitment of woody debris.

Twin Creek was approximately 2.9 km in length, it drained 994 ha (2,186 acres), and the stream gradient was 6%. Sand comprised the majority of the stream substrate.

Rutledge Creek was approximately 6.4 km in length, it drained 2,720 ha (5,988 acres), and the stream gradient was 5%. Sand and small gravel 2 to 4 mm in diameter comprised the major portion of stream substrate. There was a large amount of woody debris crossing the stream but not in the active stream channel.

Montana Creek was approximately 8.2 km long, it drained 3,142 ha (6,913 acres), and the stream gradient for the entire stream was 9%, the stream gradient in the study reach was 7%. Land owners removed most of the timber in the riparian zone. Gravel, greater than 64 mm in diameter, comprised the majority of the stream substrate.

Spotted Louis Creek was 6.7 km in length, but only 2.7 km was accessible to fish due to a major waterfall. The stream gradient for the reach below the waterfall was 9%. The stream was steep, and cascades and high gradient riffles comprised the majority of stream habitat. Large boulders and cobble comprised most of the stream substrate. The stream drained 3,502 ha (7,705 acres).

Buck Creek was a tributary of Canyon Creek, which was a tributary of the Little North Fork Clearwater River (Figure 2). Buck Creek was a fourth-order stream with two major third-order tributaries, Bathtub and Papoose creeks. Buck Creek was approximately 8 km long, width varied from 8.6 m at the mouth to 1 m

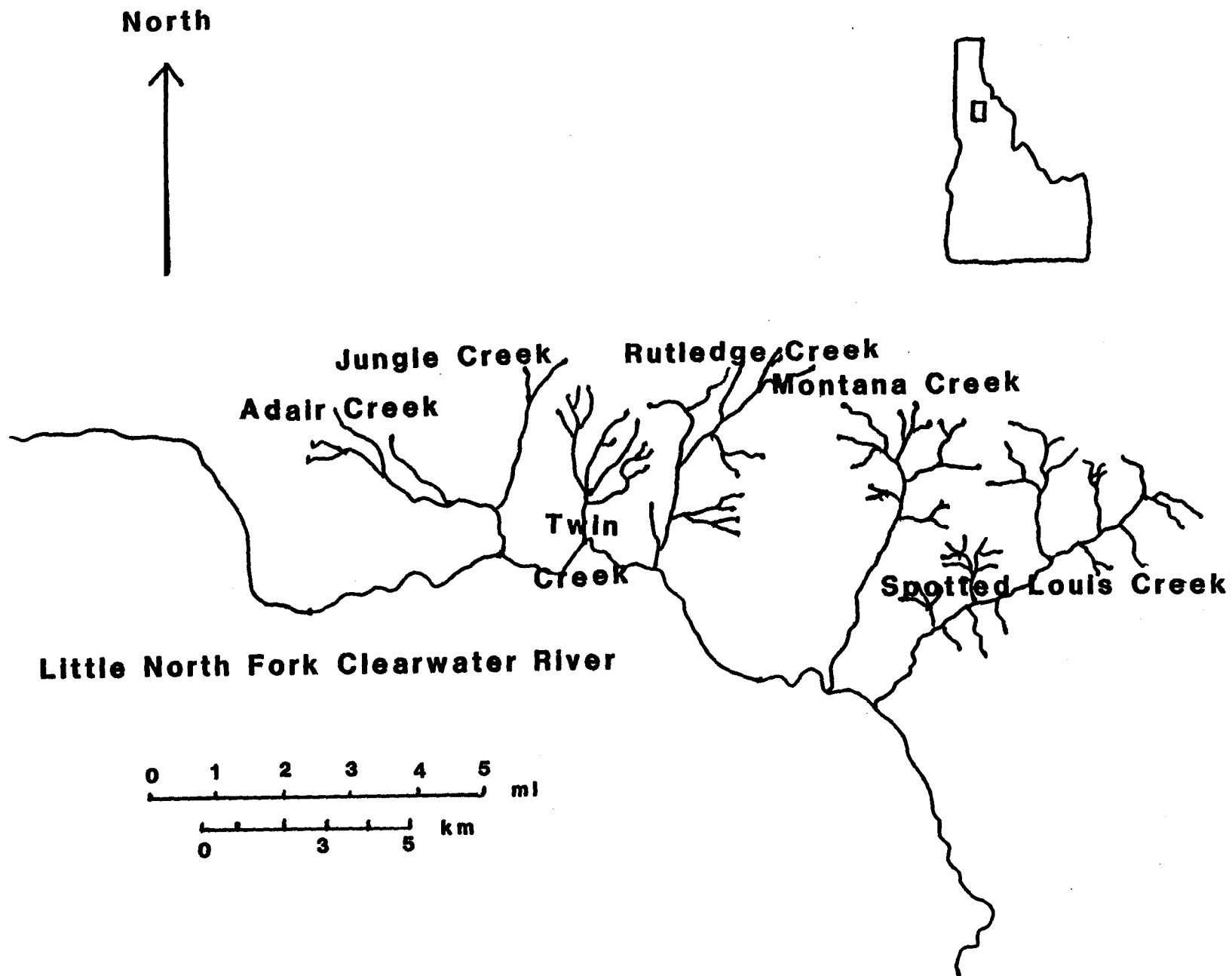
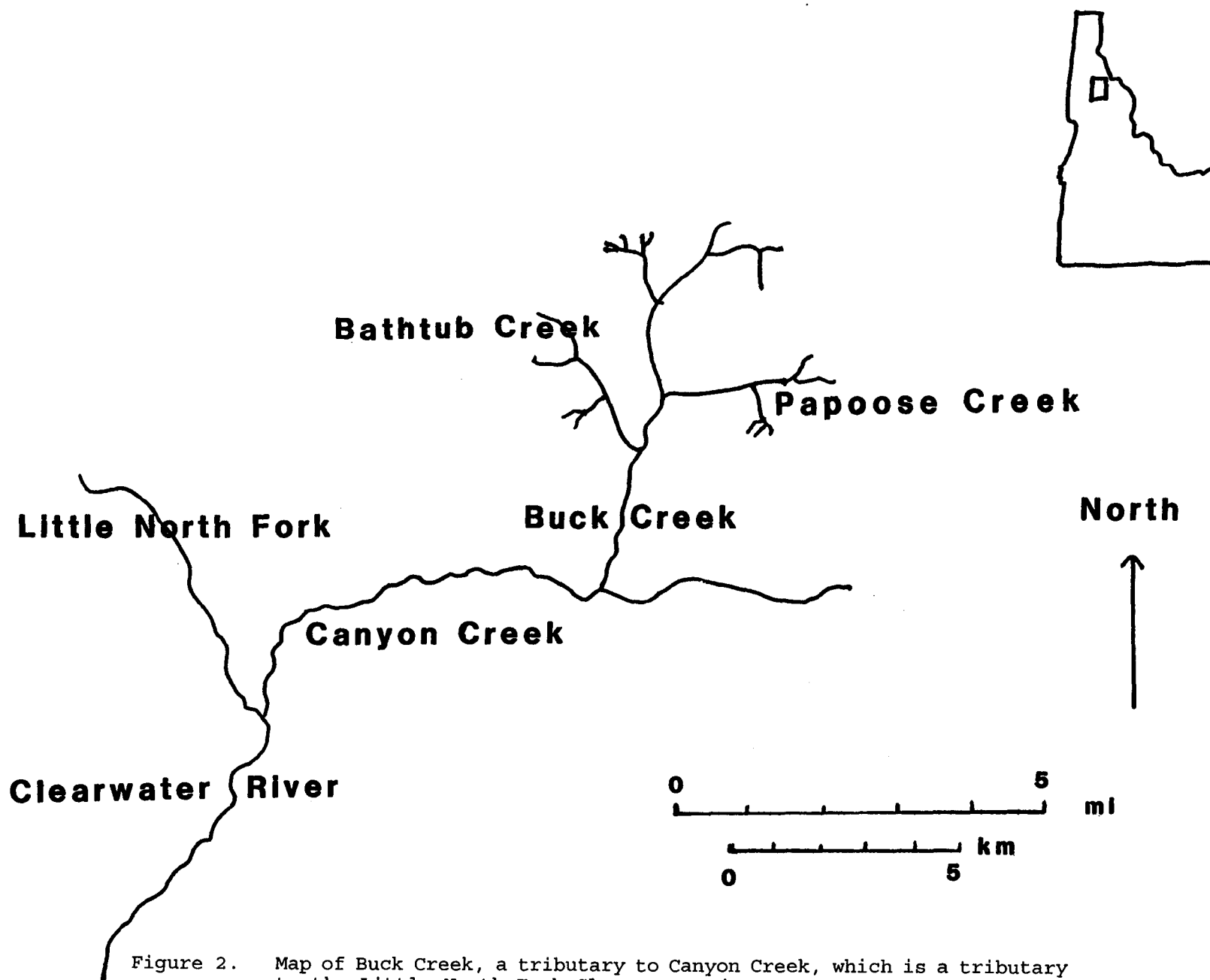


Figure 1. Map of Adair, Twin, Rutledge, Montana, and Spotted Louis creeks, tributaries to the Little North Fork Clearwater River.





in the headwaters, and the gradient was 3.3%. The stream channel was classified as B2 channel type (Rosgen 1985) in the lower 6 km and A2 channel type above the confluence with Papoose Creek. The watershed was heavily forested. A road across the headwaters of the drainage provided the only access into the area.

## **METHODS**

### **Habitat Evaluation**

To evaluate the habitat, we used a modified procedure similar to the one described by Hanken and Reeves (1985). Biologists from Region 5 of the US Forest Service developed the procedure and we modified it to fit our system. We established eight habitat types (Table 1). We used a hip chain to measure the length of each habitat type. Each habitat type was numbered consecutively within a reach. We defined a reach as a change in stream channel classification (e.g., B2 to A2). Sometimes we used a tributary to mark the end of a reach. Technicians recorded the length, mean width, mean depth, and maximum depth for each habitat type. Pool measurements included maximum depth, mean width, and maximum pool crest depth, which is defined as the deepest water level at the downstream end of the pool. Residual pool volume was calculated by multiplying length, width, and the difference between maximum pool depth and maximum pool crest depth. All measurements were recorded on a special form (Appendix A), and we used a computer program to summarize the habitat data.

### **Stream Stability**

We used the Riffle Armor Stability Index (RASI), developed by Gary Kappesser (Forest hydrologist, Panhandle National Forest), to rate stream channel stability. Bankfull stream channel cross section and substrate size distribution were measured and used to calculate stream channel stability rating.

Channel cross section measurements required the selection of a trapezoidal shaped low gradient riffle in a straight section of the stream. We stretched a 30-m tape perpendicular across the stream channel between the high water marks. Technicians used a hand-held level and a stadia rod to measure the channel profile. We established a bench mark and measured the height for future comparisons. The frequency of cross section measurements depended on the uniformity of the stream bottom. The high water mark and the water's edge must be indicated for the process to be usable. To determine the stream gradient, we made a longitudinal stream profile. The profile began 30 m upstream, when possible, and continued 30 m downstream, when possible, and included the channel profile transect.

We used the Wolman Pebble Count procedure to determine the substrate size distribution (Wolman 1954). A minimum sample size of 200 substrate particle size measurements was needed. We determined the sampling points by pacing a transect across the channel from high water mark to high water mark in a heel to toe method. The particle at the end of the toe was measured and tallied using the Udden-Wentworth size classes, <2 mm, 2-4 mm, <4-8 mm, <8-16 mm, <16-32 mm, <32-64 mm, <64-128 mm, <128-256 mm, <256-512 mm, and <512-1024 mm. Particles greater than 1,024 mm were counted as many times as encountered.

The substrate particle size class or 'D' number is the index of stability. The 'D' number is determined by comparing the critical grain size moved at bankfull discharge to the cumulative particle size distribution of riffle material determined by the Wolman Pebble Count. For example, if the largest

Table 1. Description of habitat types used for habitat evaluation in tributaries to the Little North Fork Clearwater River, 1991.

- 
1. Low Gradient Riffle - Shallow reaches with moderate current velocity and moderate turbulence. Substrate is usually composed of gravel, pebble, and cobble sized particles. Gradient is usually less than 4%.
  2. High Gradient Riffle - Gradient exceeds 4% and water flows swiftly with considerable turbulence. Substrate is coarser than low gradient riffles.
  3. Cascades - The steepest riffle habitat type consisting of alternating small waterfalls and shallow pools. Substrate is usually bedrock and boulders.
  4. Run - Long, most often straight, low gradient stream sections with stable banks and no major flow obstructions. Typical substrates are gravel and cobbles.
  5. Glides - Shallow water with an even flow that lacks pronounced turbulence. Glides are most frequently located at the transition between a pool and the head of a riffle.
  6. Pocketwater - A series a small pools surrounded by swiftly flowing water usually caused by eddies behind boulders, rubble, or logs or by potholes in the streambed.
  7. Pools - Pools are generally deeper and wider than the average width and depth of the stream, the current within it is appreciably slower than that upstream and downstream from it.
  8. Braided - More than one stream channel. Split is often caused by gravel bars and generally occurs in low gradient reaches.

particle moved at bankfull discharge was estimated to be 43 mm and 650 of the riffle particle sizes were 43 mm or less, then the resulting RASI number would be 'D65'.

### **Trout Density Estimates**

We snorkeled several habitat types in each reach to determine the number of fish present per habitat type. Fish were identified by species and length group, 0-50 mm, 51-99 mm, 100-149 mm, 150-200 mm, 201-249 mm, and >250 mm. The habitat type identification number, length, and mean width of each snorkeled habitat type were measured and recorded. Fish densities were calculated per 100 m<sup>2</sup>.

## **RESULTS**

### **Habitat Survey**

Pool habitat comprised 10%, 4%, 2%, 5%, 7%, and 7.8% of the total habitat area in Adair, Rutledge, Twin, Montana, Spotted Louis, and Buck creeks, respectively (Tables 2-7). In Adair Creek, we found low gradient riffles and runs comprised 85% of the total habitat area (Table 2). In Rutledge Creek, high gradient riffles, low gradient riffles, and braided stream channels comprised 86% of the total habitat area that we surveyed (Table 3). In Twin Creek, we classified 58% of the habitat as low gradient riffles and high gradient riffles. Runs and cascades comprised 23% and 10%, respectively, of the habitat surveyed (Table 4). In Montana Creek, we classified 86% of the habitat as high gradient riffles, low gradient riffles, and cascades (Table 5). In Spotted Louis, cascades comprised 74% of the habitat surveyed (Table 6). We surveyed 7.1 km of Buck Creek. Riffles comprised 82.4% of the habitat surveyed (Table 7).

### **Stream Channel Stability**

Substrate particles between 0 and 4 mm in diameter comprised over 50% of the total number of particles counted in Adair, Rutledge, and Twin creeks (Figures 3-5). This same size group comprised over 50% in Spotted Louis Creek (Figure 6) because the selected transect was the only relatively flat area and acted as a depositional zone. In Montana Creek, particles 0 to 4 mm in diameter comprised less than 30% of the number of particles counted (Figure 7). In Buck Creek, particles 0-4 mm comprised less than 13% of the number of particles counted (Figure 8).

The 'D' numbers for Buck Creek ranged from 6 to 49. The critical grain size, the largest particle transported at bankful discharge, ranged from 5.4 mm to 65.7 mm (Table 8). I failed to indicate the high water mark on the stream channel profile measurements for the other five tributaries, therefore the RASI rating could not be calculated.

### **Trout Density Estimates**

Cutthroat trout densities per 100 m<sup>2</sup> in Adair, Rutledge, Twin, Montana, and Spotted Louis creeks were 4, 8, 11, 17, and 21, respectively (Tables 9-13). We found most of the trout in pool habitat. Trout in the 101-150 mm length group

Table 2. Summary of habitat types, total length, and total **area** for reaches surveyed in Adair Creek, July 1991.

| Habitat types | Number | Total length (m) | Percent total length | Total area (m <sup>2</sup> ) | Percent total area |
|---------------|--------|------------------|----------------------|------------------------------|--------------------|
| LGR           | 29     | 1,341            | 42.0                 | 5,110                        | 45                 |
| HGR           | 2      | 92               | 3.0                  | 315                          | 3                  |
| CAS           | 2      | 68               | 2.0                  | 266                          | 2                  |
| PLS           | 29     | 268              | 9.0                  | 1,180                        | 10                 |
| RUN           | 21     | 1,381            | 44.0                 | 4,559                        | 10                 |
| BRS           | 1      | 13               | 0.4                  | 20                           | 0.2                |
| Total         |        | 3,163            |                      | 11,450                       |                    |

LGR - Low gradient riffle  
HGR - High gradient riffle  
CAS - Cascades  
PLS - Pools  
RUN - Runs  
BRS - Braided (multiple channels)

Table 3. Summary of habitat types, total length, and total area for reaches in Rutledge Creek, July 1991.

| Habitat types | Number | Total length (m) | Percent total length | Total area (m <sup>2</sup> ) | Percent total area |
|---------------|--------|------------------|----------------------|------------------------------|--------------------|
| LGR           | 5      | 341              | 9                    | 1,385                        | 10                 |
| HGR           | 20     | 2,113            | 55                   | 5,921                        | 42                 |
| CAS           | 8      | 349              | 9                    | 895                          | 6                  |
| PLS           | 17     | 126              | 3                    | 614                          | 4                  |
| RUN           | 3      | 85               | 2                    | 468                          | 3                  |
| BRS           | 8      | 768              | 20                   | 4,746                        | 34                 |
| Total         |        | 3,782            |                      | 14,029                       |                    |

LGR - Low gradient riffle  
 HGR - High gradient riffle  
 CAS - Cascades  
 PLS - Pools  
 RUN - Runs  
 BRS - Braided (multiple channels)

Table 4. Summary of habitat types, total length, and total area for reaches surveyed in Twin Creek, July 1991.

| Habitat types | Number | Total length (m) | Percent total length | Total area (m <sup>2</sup> ) | Percent total area |
|---------------|--------|------------------|----------------------|------------------------------|--------------------|
| LGR           | 9      | 949              | 50                   | 1,618                        | 44                 |
| HGR           | 4      | 221              | 12                   | 517                          | 14                 |
| CAS           | 3      | 148              | 8                    | 360                          | 10                 |
| PLS           | 9      | 38               | 2                    | 91                           | 2                  |
| RUN           | 2      | 419              | 23                   | 859                          | 23                 |
| BRS           | 3      | 134              | 7                    | 268                          | 7                  |
| Total         |        | 1,909            |                      | 3,713                        |                    |

LGR - Low gradient riffle  
 HGR - High gradient riffle  
 CAS - Cascades  
 PLS - Pools  
 RUN - Runs  
 BRS - Braided (multiple channels)

Table 5. Summary of habitat types, total length, and total area for reaches in Montana Creek, July 1991.

| Habitat types | Number | Total length (m) | Percent total length | Total area (m <sup>2</sup> ) | Percent total area |
|---------------|--------|------------------|----------------------|------------------------------|--------------------|
| LGR           | 16     | 700              | 16                   | 3,238                        | 18                 |
| HGR           | 35     | 2,410            | 56                   | 9,743                        | 55                 |
| CAS           | 14     | 572              | 13                   | 2,256                        | 13                 |
| PLS           | 40     | 188              | 4                    | 824                          | 5                  |
| BRS           | 8      | 459              | 11                   | 1,619                        | 9                  |
| Total         |        | 4,329            |                      | 17,680                       |                    |

LGR - Low gradient riffle

HGR - High gradient riffle

CAS - Cascades

PLS - Pools

BRS - Braided (multiple channels)

Table 6. Summary of habitat types, total length, and total area for reaches in Spotted Louis Creek, July 1991.

| Habitat types | Number | Total length (m) | Percent total length | Total area (m <sup>2</sup> ) | Percent total area |
|---------------|--------|------------------|----------------------|------------------------------|--------------------|
| LGR           | 1      | 20               | 1                    | 120                          | 1                  |
| HGR           | 10     | 638              | 17                   | 3,432                        | 18                 |
| CAS           | 29     | 2,894            | 76                   | 14,034                       | 74                 |
| PLS           | 34     | 260              | 7                    | 1,401                        | 7                  |
| Total         |        | 3,812            |                      | 18,987                       |                    |

LGR - Low gradient riffle  
HGR - High gradient riffle  
CAS - Cascades  
PLS - Pools



Table 7. Summary of habitat types, total length, and total area for reaches in Buck Creek, July 1991.

| Habitat types | Number | Total length (m) | Percent total length | Total area (m <sup>2</sup> ) | Percent total area |
|---------------|--------|------------------|----------------------|------------------------------|--------------------|
| LGR           | 42     | 3,356            | 47.4                 | 20,803                       | 52.88              |
| HGR           | 33     | 2,520            | 35.6                 | 11,613                       | 29.52              |
| CAS           | 8      | 392              | 5.5                  | 1,675                        | 4.26               |
| RUN           | 3      | 78               | 1.1                  | 529                          | 1.34               |
| PLS           | 52     | 550              | 7.8                  | 3,456                        | 8.8                |
| BRS           | 3      | 185              | 2.6                  | 1,265                        | 3.2                |
| Totals        |        | 7,082            |                      | 39,341                       |                    |

LGR - Low gradient riffle

HGR - High gradient riffle

CAS - Cascades

RUN - Runs

PLS - Pools

BRS - Braids (multiple channels)

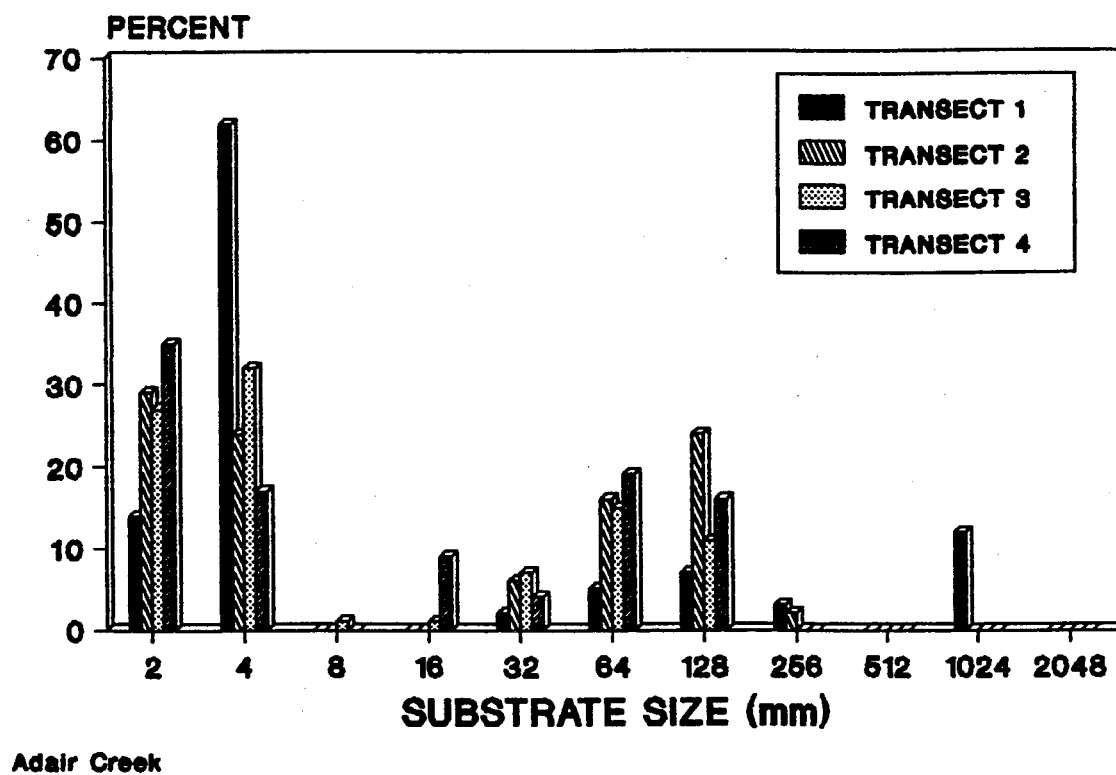


Figure 3. Particle size distribution (Wolman Pebble Count) in Adair Creek, July 1991.

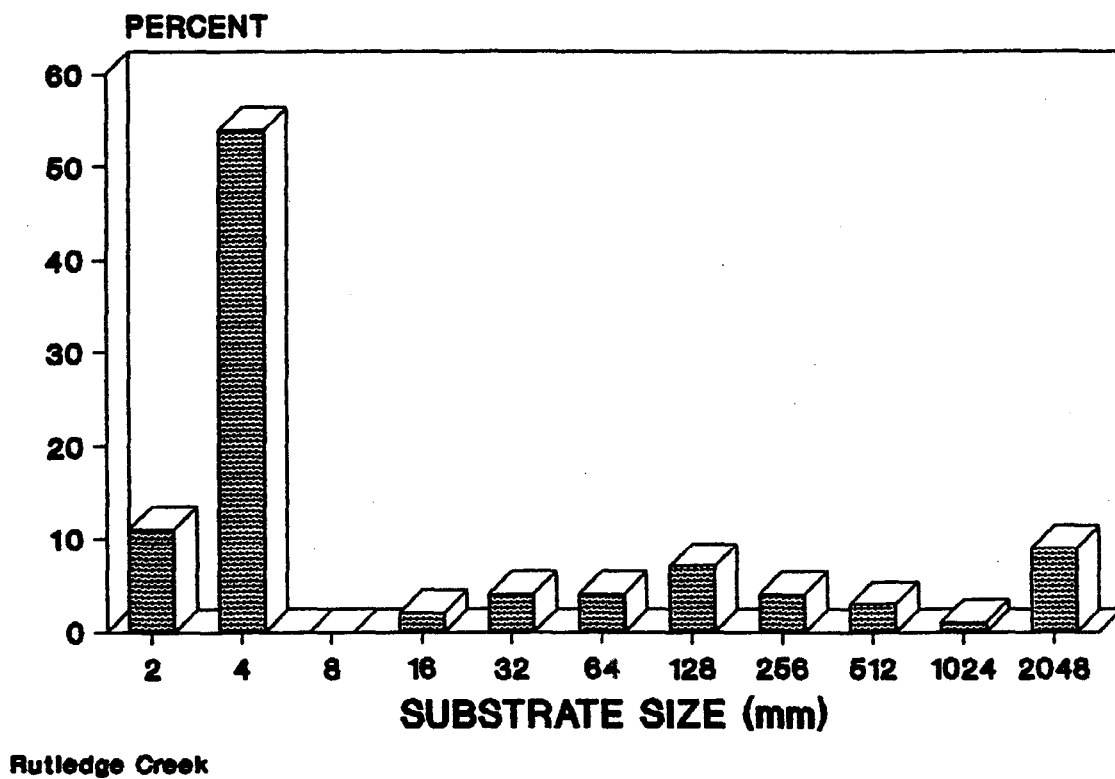


Figure 4. Particle size distribution (Wolman Pebble Count) in Rutledge Creek, July 1991 (one transect).

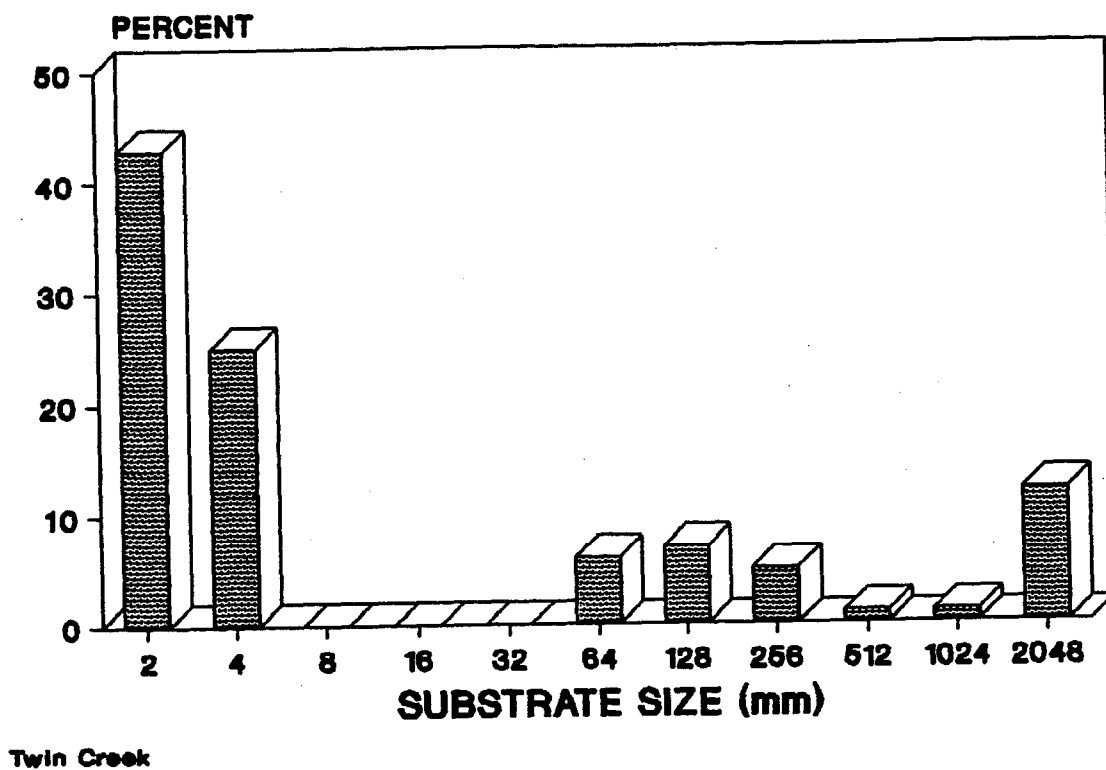
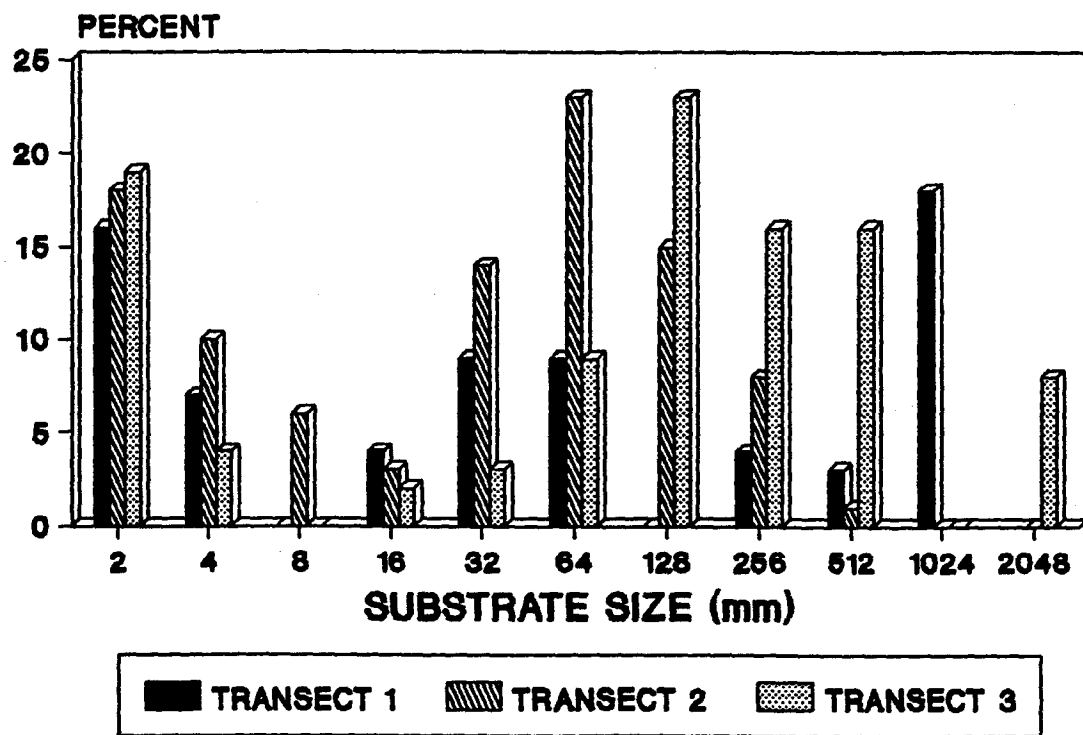


Figure 5. Particle size distribution (Wolman Pebble Count) in Twin Creek, July 1991 (one transect).



Montana Creek

Figure 6. Particle size distribution (Wolman Pebble Count) in Spotted Louis Creek, July 1991 (one transect).

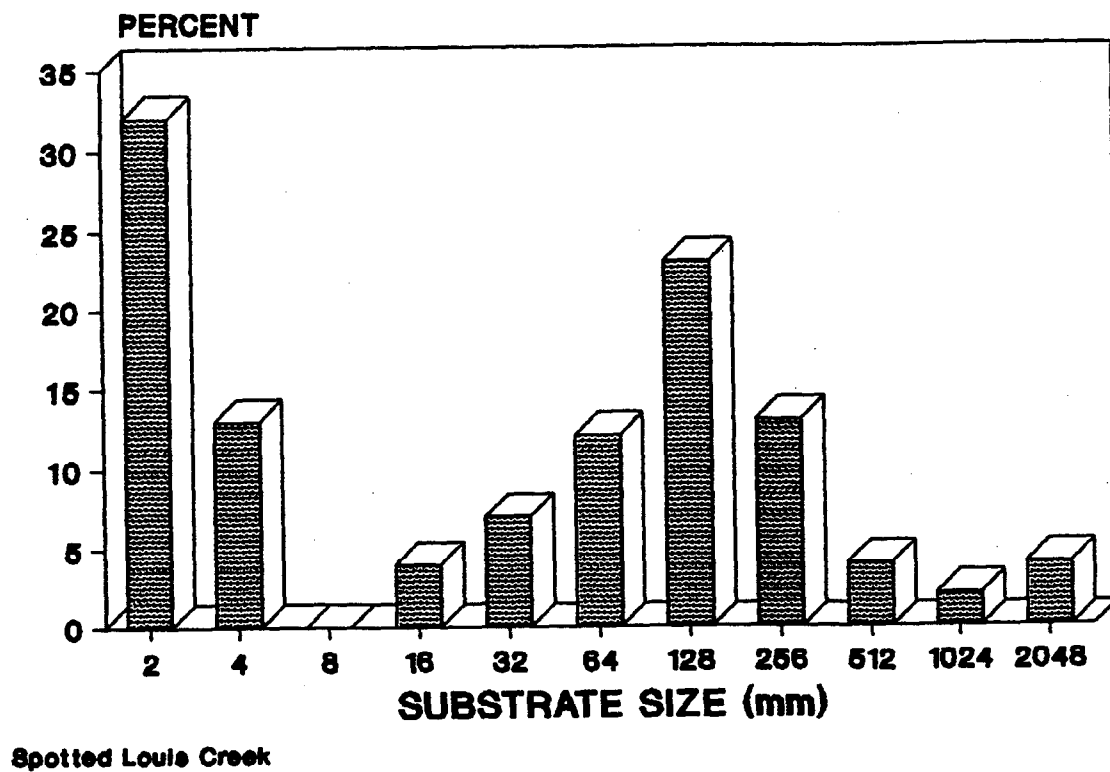
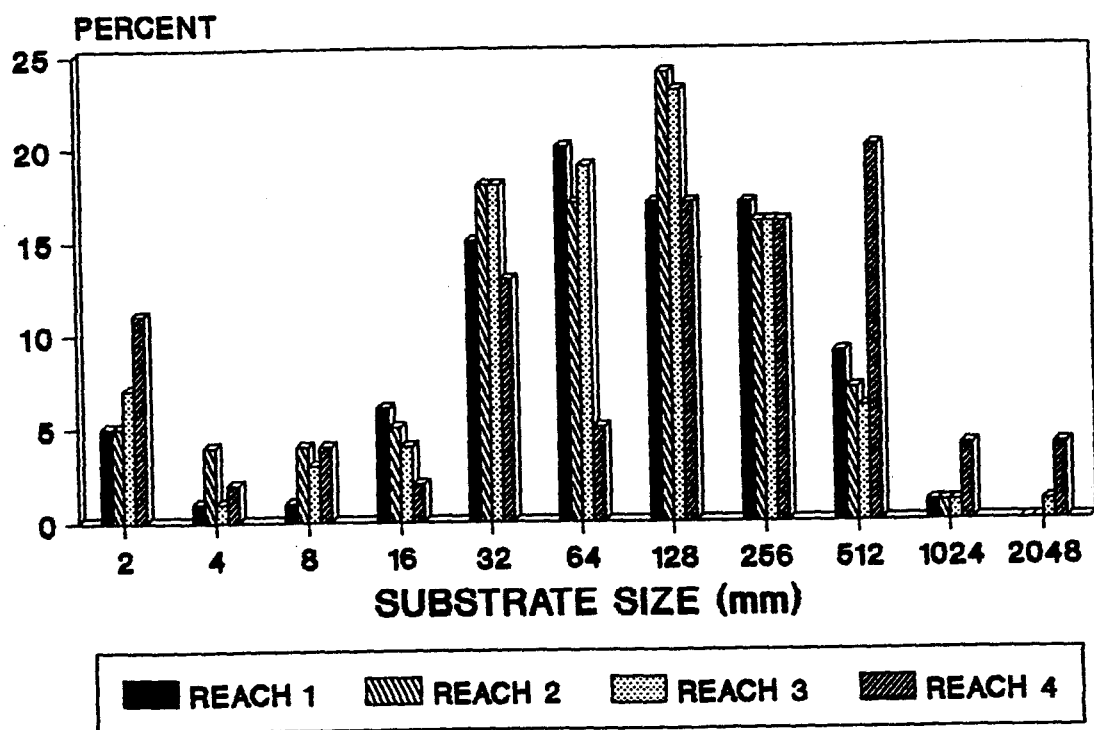


Figure 7. Particle size distribution (Wolman Pebble Count) in Montana Creek, July 1991.



Buck Creek

Figure 8. Particle size distribution (Wolman Pebble Count) in Buck Creek, July 1991 (transects within each reach were combined).

Table 8. Stream channel stability rating (D number) and maximum particle size (critical grain size) moved during bank full discharge for Buck Creek, 1991.

| Reach number | Cross section number | D number | Critical grain size |
|--------------|----------------------|----------|---------------------|
| 1            | 1                    | 45       | 64.8                |
|              | 2                    | 34       | 40.3                |
|              | 3                    | 42       | 60.3                |
| 2            | 1                    | 49       | 65.7                |
|              | 2                    | 6        | 5.4                 |
|              | 3                    | 34       | 15.3                |
| 3            | 1                    | 22       | 24.7                |
|              | 2                    | 27       | 25.0                |
|              | 3                    | 25       | 18.8                |
| 4            | 1                    | 35       | 65.1                |
|              | 2                    | 42       | 50.0                |



Table 9. Summary of habitat and fish population data observed in snorkeling transects in Adair Creek, July 1991.

| number      | Reach number | Transact type | Mean width (m) | Length (m) | Area (m <sup>2</sup> ) | Number of cutthroat in each length group (mm) |        |         |         |     | Total number of fish | Fish per m <sup>2</sup> | Fish per 100 m <sup>2</sup> |
|-------------|--------------|---------------|----------------|------------|------------------------|---|--------|---------|---------|-----|----------------------|-------------------------|-----------------------------|
|             |              |               |                |            |                        | 0-50  | 51-100 | 101-150 | 151-200 | 201 |                      |                         |                             |
| 1           | 1            | PLS           | 5.0            | 6.8        | 34.0                   |   | 1      |         |         |     | 1                    | 0.03                    | 2.9                         |
|             | 2            | RUN           | 6.0            | 24.3       | 145.8                  |   | 2      | 2       |         |     | 4                    | 0.03                    | 2.7                         |
|             | 3            | PLS           | 2.8            | 9.8        | 27.4                   | 1   | 1      |         | --      |     | 2                    | 0.07                    | 7.3                         |
|             | 4            | RUN           | 2.9            | 14.5       | 42.1                   |   | 2      |         |         |     | 2                    | 0.05                    | 4.8                         |
|             | 5            | RUN           | 3.0            | 7.7        | 23.1                   |   |        | 1       |         |     | 1                    | 0.04                    | 4.3                         |
| Totals      |              | PLS           |                |            | 61.4                   |   |        |         |         |     | 3                    | 0.05                    | 4.9                         |
|             |              | RUN           |                |            | 211.0                  |   |        |         |         |     | 7                    | 0.03                    | 3.3                         |
| Grand Total |              |               |                |            | 272.4                  |   |        |         |         |     | 10                   | 0.04                    | 4.0                         |

PLS - Pools  
RUN - Runs

Table 10. Summary of habitat and fish population data in snorkeling transects in Rutledge Creek, July 1991.

| Reach number | Transect number | Habitat type | Mean width (m) | Length (m) | Area (m <sup>2</sup> ) | Number of cutthroat in each length group (mm) |        |         |              |      | Total number of fish | Fish per m <sup>2</sup> | Fish per 100 m <sup>2</sup> |
|--------------|-----------------|--------------|----------------|------------|------------------------|---|--------|---------|--------------|------|----------------------|-------------------------|-----------------------------|
|              |                 |              |                |            |                        | 0-50  | 51-100 | 101-150 | 151-200      | 201  |                      |                         |                             |
| 1            | 1               | PLS#1        | 3.0            | 2.0        | 6.0                    |   |        |         |              |      | 0                    | 0.00                    | 00.0                        |
|              | 2               | LGR          | 4.0            | 8.0        | 32.0                   |   |        |         |              |      | 0                    | 0.00                    | 00.0                        |
|              | 3               | PLS#6        | 6.0            | 10.0       | 60.0                   |   | 1      | 3       | 1            |      | 5                    | 0.08                    | 8.3                         |
|              | 4               | PLS#7        | 6.0            | 9.0        | 54.0                   | 1   | 3      | 6       | 1-rb<br>1-ct | 1-rb | 13                   | 0.24                    | 24.0                        |
|              | 5               | PLS          | 2.5            | 4.0        | 10.0                   |   |        | 2       |              |      | 2                    | 0.24                    | 20.0                        |
|              | 6               | RUN          | 3.0            | 16.0       | 48.0                   |   |        | 3       | 2            |      | 5                    | 0.1                     | 10.4                        |
|              | 7               | LGR          | 3.0            | 7.0        | 21.0                   |   |        | 1       |              |      | 1                    | 0.05                    | 4.7                         |
|              | 8               | PLS#8        | 4.5            | 5.0        | 22.5                   |   |        | 1       |              |      | 1                    | 0.04                    | 4.4                         |
|              | 9               | PLS#9        | 4.0            | 7.0        | 28.0                   |   | 3      | 1       |              |      | 4                    | 0.14                    | 14.2                        |
|              | 10              | PLS#10       | 7.0            | 9.0        | 63.0                   |   |        | 1       |              |      | 1                    | 0.02                    | 1.5                         |
| Totals       |                 | PLS          |                |            | 243.5                  |   |        |         |              |      | 26                   | 0.11                    | 10.7                        |
|              |                 | LGR          |                |            | 53.0                   |   |        |         |              |      | 1                    | 0.02                    | 2.0                         |
|              |                 | RUN          |                |            | 48.0                   |   |        |         |              |      | 5                    | 0.1                     | 10.0                        |
| Grand Total  |                 |              |                |            | 344.5                  |   |        |         |              |      | 32                   | 0.9                     | 9.0                         |

PLS - Pools  
RUN - Runs

Table 11. Summary of habitat and fish population data observed in snorkeling transects in Twin Creek, July 1991.

| Reach number | Transect number | Habitat type | Mean width (m) | Length (m) | Area (m <sup>2</sup> ) | Number of cutthroat in each length group (mm) |        |         |         |     | Total number of fish | Fish per m <sup>2</sup> | Fish per 100 m <sup>2</sup> |
|--------------|-----------------|--------------|----------------|------------|------------------------|---|--------|---------|---------|-----|----------------------|-------------------------|-----------------------------|
|              |                 |              |                |            |                        | 0-50  | 51-100 | 101-150 | 151-200 | 201 |                      |                         |                             |
| 1            | 1               | PLS#2        | 3.0            | 3.0        | 9.0                    |   |        |         |         |     | 0                    | 0.00                    | 00.0                        |
|              | 2               | PLS#3        | 2.0            | 4.0        | 8.0                    |   |        | 2       |         |     | 2                    | 0.25                    | 25.0                        |
|              | 3               | PLS#4        | 2.0            | 4.0        | 8.0                    | 1   | 1      |         |         |     | 2                    | 0.25                    | 25.0                        |
|              | 4               | LGR#4        | 3.0            | 7.0        | 21.0                   |   |        | 1       |         |     | 1                    | 0.05                    | 5.0                         |
|              | 5               | PLS          | 1.5            | 1.5        | 2.3                    |   |        | 1       | 1       |     | 2                    | 0.87                    | 87.0                        |
|              | 6               | LGR#5        | 2.0            | 8.0        | 16.0                   |   |        | 1       |         |     | 1                    | 0.06                    | 6.0                         |
|              | 7               | PLS#5        | 3.0            | 5.0        | 15.0                   |   |        | 1       |         |     | 1                    | 0.07                    | 7.0                         |
| Totals       |                 | PLS          |                |            | 42.3                   |   |        |         |         |     | 7                    | 0.2                     | 20.0                        |
|              |                 | LGR          |                |            | 37.0                   |   |        |         |         |     | 2                    | 0.05                    | 5.0                         |
| Grand Total  |                 |              |                |            | 79.3                   |   |        |         |         |     | 9                    | 0.11                    | 11.0                        |

PLS - Pools  
LGR - Low gradient riffle

Table 12. Summary of habitat and fish population data observed in snorkeling transects in Montana Creek, July 1991.

| Reach number | Transect number | Habitat type | Mean width (m) | Length (m) | Area (m <sup>2</sup> ) | Number of cutthroat in each length group (mm) |        |         |         |     | Total number of fish | Fish per m <sup>2</sup> | Fish per 100 m <sup>2</sup> |
|--------------|-----------------|--------------|----------------|------------|------------------------|---|--------|---------|---------|-----|----------------------|-------------------------|-----------------------------|
|              |                 |              |                |            |                        | 0-50  | 51-100 | 101-150 | 151-200 | 201 |                      |                         |                             |
| 1            | 1               | PLS#1        | 7.0            | 10.0       | 70.0                   | 3   | 1      | 5       | 2       | --  | 11                   | 0.16                    | 15.7                        |
|              | 2               | PLS#2        | 4.5            | 8.0        | 36.0                   | 1   | --     | 2       | --      | --  | 3                    | 0.08                    | 8.3                         |
|              | 3               | PLS#15       | 4.0            | 3.0        | 12.0                   |   | 1      | 2       |         | --  | 3                    | 0.25                    | 25.0                        |
|              | 4               | PLS#16       | 4.0            | 3.0        | 12.0                   | 2   | 3      | 3       |         | --  | 8                    | 0.67                    | 66.7                        |
|              | 5               | HGR#7        | 4.5            | 20.0       | 90.0                   |   | 2      | 2       |         | --  | 4                    | 0.04                    | 4.4                         |
|              | 6               | HGR#8        | 4.0            | 15.0       | 60.0                   | 1   | 2      | 1       | 1       | --  | 5                    | 0.08                    | 8.3                         |
|              | 7               | LGR#11       | 4.0            | 38.0       | 152.0                  | 1   | 1      | --      | --      | --  | 2                    | 0.01                    | 1.3                         |
|              | 8               | HGR          | 3.0            | 6.0        | 18.0                   | --  | 6      | 6       | 3       | 1   | 16                   | 0.89                    | 88.9                        |
|              | 9               | HGR          | 3.5            | 15.0       | 52.5                   | --  | 3      | 4       | 1       | --  | 8                    | 0.15                    | 15.2                        |
|              | 10              | PLS#6        | 5.0            | 3.0        | 15.0                   | --  | --     | --      | --      | --  | 0                    | 0.00                    | 00.0                        |
|              | 11              | PLS#7        | 3.0            | 5.0        | 15.0                   | --  | 2      | 3       |         |     | 5                    | 0.33                    | 33.3                        |
|              | 12              | PLS#8        | 5.0            | 4.0        | 20.0                   | --  | 2      | 5       | 4       | 1   | 12                   | 0.6                     | 60.0                        |
|              | 13              | PLS#11       | 3.0            | 3.0        | 9.0                    | --  | 5      | 6       | --      | --  | 11                   | 1.2                     | 122.2                       |
|              | 14              | LGR          | 3.0            | 10.0       | 30.0                   | --  | --     | 6       | --      | --  | 6                    | 0.2                     | 20.0                        |
|              | 15              | PLS#14       | 6.0            | 6.0        | 36.0                   | --  | 2      | 5       | 4       | 2   | 13                   | 0.36                    | 36.1                        |
| Totals       |                 | LGR          |                |            | 182.0                  | --  | --     | --      | --      | --  | 8                    | 0.04                    | 4.4                         |
|              |                 | HGR          |                |            | 220.5                  | --  | --     | --      | --      | --  | 33                   | 0.15                    | 15.0                        |
|              |                 | PLS          |                |            | 225.0                  | --  | --     | --      | --      | --  | 66                   | 0.29                    | 29.3                        |
| Grand Total  |                 |              |                |            | 627.5                  | --  | --     | --      | --      | --  | 107                  | 0.17                    | 17.0                        |

PLS - Pools  
HGR - High gradient riffle  
LGR - Low gradient riffle

Table 13. Summary of total area and number of westslope cutthroat trout in snorkeling transects in Spotted Louis Creek, July 1991.

| number      | Reach number | Transect type | Mean width (m) | Length (m) | Number of cutthroat in each length group (mm) |      |        |         |         | Total number of fish | Fish per m <sup>2</sup> | Fish per 100 m <sup>2</sup> |
|-------------|--------------|---------------|----------------|------------|---|------|--------|---------|---------|----------------------|-------------------------|-----------------------------|
|             |              |               |                |            | Area (m <sup>2</sup> )                        | 0-50 | 51-100 | 101-150 | 151-200 | 201                  |                         |                             |
| 1           | 1            | PLS#1         | 6.0            | 6.0        | 36  | --   | --     | --      | --      | 0                    | 0.00                    | 00.0                        |
|             | 2            | PLS#2         | 5.0            | 8.0        | 40  | --   | 2      | --      | --      | 2                    | 0.05                    | 5.0                         |
|             | 3            | HGR           | 4.0            | 13.0       | 52  | 1    | --     | --      | --      | 1                    | 0.02                    | 1.9                         |
|             | 4            | PLS#24        | 3.5            | 10.0       | 35  | 2    | 6      | 3       | --      | 11                   | 0.31                    | 31.4                        |
|             | 5            | PLS#25        | 7.0            | 5.0        | 35  | 7    | 11     | 4       | --      | 22                   | 0.63                    | 62.9                        |
|             | 6            | PLS#25A       | 3.0            | 3.0        | 9   | 2    | 3      | 2       | 1       | 8                    | 0.89                    | 88.9                        |
| Totals      |              | PLS           |                |            | 155   | --   | --     | --      | --      | 43                   | 0.28                    | 27.7                        |
|             |              | HGR           |                |            | 52  | --   | --     | --      | --      | 1                    | 0.02                    | 1.9                         |
| Grand Total |              |               |                |            | 207   | --   | --     | --      | --      | 44                   | 0.21                    | 21.0                        |

PLS - Pools  
HGR - High gradient riffle

were the most abundant size group. We observed 4 trout over 200 mm, which is typical of adfluvial westslope cutthroat trout where the longer fish migrate downstream after spawning. We surveyed 19 transects in Buck Creek, 13 pools, 3 low gradient riffles, 2 high gradient riffles, and 1 run. We snorkeled 902 m<sup>2</sup> of pool habitat and 1,114.5 m<sup>2</sup> of riffle habitat. The mean number of cutthroat trout per 100 m<sup>2</sup> was 14 and 1.7, in pool habitat and riffle habitat, respectively (Table 14). Reach #4 had the highest density followed by #3, #1, and #2 (Table 14).

## DISCUSSION

### Habitat

In Buck Creek, pool habitat comprised almost 9% of the total area surveyed. In the other tributaries of the Little North Fork Clearwater River, pool habitat comprised between 2% and 10% of the stream habitat (Table 15). No correlation existed between cutthroat trout densities (dependent variable) and the percent of the watershed that had been logged in the past 20 years ( $r=-.04$ ). A weak negative correlation existed between cutthroat trout densities and the percent of pool habitat ( $r=-.31$ ). A very weak negative correlation existed between cutthroat trout densities and the percent of the substrate less than 4 mm in diameter ( $r=-.10$ ).

Forest Service personnel have compared stream habitat and trout densities in logged and unlogged drainages. They found a 53% loss in mean residual pool volume in 'B' type stream channels in logged drainages ( $p=0.01$ ). They found a 34% loss in mean residual pool volume in 'A' type stream channels in logged drainages ( $p=0.15$ ). I found a mean loss in residual pool volume of 79% between Buck Creek, an unmanaged drainage, and the other five managed drainages. However, I did not find a significant correlation between cutthroat trout densities and mean residual pool volume ( $r=.24$ ).

Buck Creek is a good example of an undamaged stream. Large organic debris created pools, provided cover for fish, and trapped gravel. We measured several 2-m high debris jams. Gravel had filled in behind the debris jams, which demonstrates the importance of LOD for stabilizing bedload gravel and promoting stream stability. In several locations, stable gravel bars split the stream into two or three channels. We observed two small actively eroding areas totaling 25 m long. The riparian zone was in excellent condition, and LOD recruitment was plentiful. In Adair, Twin, and Rutledge creeks, LOD in the active stream channel was absent. The riparian zone lacked sufficient trees for recruitment of woody debris to the stream due to past harvest activities. The riparian zone in the lower end of Montana Creek had a sufficient number of trees to provide woody debris to the stream. However, the riparian zone in the upper end of Montana Creek did not contain very many trees for woody debris recruitment due to harvest and nature. The riparian zone in Spotted Louis Creek has not been logged and trees were available for recruitment to the stream.

### Stream Channel Stability

Buck Creek is a very stable stream with D numbers less than 49. Index numbers less than 70 indicate systems in dynamic equilibrium. Index numbers greater than 90 indicate systems out of equilibrium and/or where geomorphic thresholds have been exceeded. Index numbers between 70 and 90 require a hydrologist's expert judgement (Kappesser, personal communication).

Table 14. Summary of total area and number of westslope cutthroat trout in snorkeling transects in Buck Creek, July 1991.

| Reach number | Transect number | Habitat type | Mean width | Length (m) | Area (m <sup>2</sup> ) | Number of cutthroat | Fish per m <sup>2</sup> | Fish per 100 m <sup>2</sup> |
|--------------|-----------------|--------------|------------|------------|------------------------|---------------------|-------------------------|-----------------------------|
| 1            | 1               | PLS#2        | 5.5        | 6.0        | 33.0                   | 1                   | 0.03                    | 3.0                         |
|              | 2               | RUN#1        | 3.0        | 7.0        | 21.0                   | 5                   | 0.24                    | 24.0                        |
|              | 3               | PLS#15       | 15.0       | 16.0       | 240.0                  | 36                  | 0.15                    | 15.0                        |
|              | 4               | LGR#15       | 12.0       | 43.0       | 516.0                  | 1                   | 0.002                   | 0.2                         |
|              | 5               | PLS#16       | 10.0       | 15.0       | 150.0                  | 3                   | 0.02                    | 2.0                         |
|              | 6               | PLS#18       | 4.0        | 15.0       | 60.0                   | 20                  | 0.33                    | 33.3                        |
|              | Total           |              |            |            | 1,020.0                | 66                  | 0.06                    | 6.0                         |
| 2            | 7               | LGR#2        | 7.0        | 25.0       | 175.0                  | 4                   | 0.02                    | 2.0                         |
|              | 8               | PLS#2        | 7.0        | 8.0        | 56.0                   | 8                   | 0.14                    | 14.0                        |
|              | 9               | LGR#8        | 8.0        | 25.0       | 200.0                  | 7                   | 0.04                    | 4.0                         |
|              | 10              | PLS#9        | 6.0        | 16.0       | 96.0                   | 5                   | 0.05                    | 5.0                         |
|              | 11              | PLS#15       | 6.0        | 15.0       | 90.0                   | 9                   | 0.10                    | 10.0                        |
|              | Total           |              |            |            | 617.0                  | 33                  | 0.05                    | 5.0                         |
| 3            | 12              | PLS#1        | 6.0        | 10.0       | 60.0                   | 12                  | 0.2                     | 20.0                        |
|              | 13              | HGR#2        | 6.0        | 25.0       | 150.0                  | 5                   | 0.03                    | 3.0                         |
|              | 14              | PLS#4        | 7.0        | 6.0        | 42.0                   | 5                   | 0.12                    | 12.0                        |
|              | Total           |              |            |            | 252.0                  | 22                  | 0.09                    | 9.0                         |
| 4            | 15              | PLS#2        | 4.0        | 5.0        | 20.0                   | 4                   | 0.2                     | 20.0                        |
|              | 16              | HGR#4        | 4.4        | 16.7       | 73.5                   | 2                   | 0.27                    | 2.7                         |
|              | 17              | PLS#4        | 4.4        | 7.5        | 33.0                   | 9                   | 0.27                    | 27.0                        |
|              | 18              | PLS#7        | 3.0        | 2.0        | 6.0                    | 5                   | 0.83                    | 83.0                        |
|              | 19              | PLS#9        | 3.4        | 5.6        | 19.0                   | 8                   | 0.42                    | 42.0                        |
|              | Total           |              |            |            | 151.5                  | 28                  | 0.18                    | 18.0                        |
| Totals       |                 | PLS          |            |            | 905.0                  | 125                 | 0.14                    | 14.0                        |
|              |                 | LGR          |            |            | 891.0                  | 12                  | 0.01                    | 1.0                         |
|              |                 | HGR          |            |            | 233.5                  | 7                   | 0.03                    | 3.0                         |
|              |                 | RUN          |            |            | 21.0                   | 5                   | 0.24                    | 24.0                        |
| Grand Total  |                 |              |            |            | 2,040.5                | 149                 | 0.07                    | 7.0                         |

LGR - Low gradient riffle  
HGR - High gradient riffle  
RUN - Runs

Table 15. Percent of each habitat type in Buck, Adair, Rutledge, Twin, Montana, and Spotted Louis creeks, July 1991.

| Stream              | PLS  | LGR  | HGR  | CAS  | RUN  | BRS  |
|---------------------|------|------|------|------|------|------|
| Buck Creek          | 8.8  | 52.9 | 29.5 | 4.0  | 1.0  | 3.0  |
| Adair Creek         | 10.0 | 45.0 | 3.0  | 2.0  | 40.0 | 0.2  |
| Rutledge Creek      | 4.0  | 10.0 | 42.0 | 6.0  | 3.0  | 34.0 |
| Twin Creek          | 2.0  | 44.0 | 14.0 | 10.0 | 23.0 | 7.0  |
| Montana Creek       | 5.0  | 18.0 | 55.0 | 13.0 | 0    | 9.0  |
| Spotted Louis Creek | 7.0  | 1.0  | 18.0 | 74.0 | 0    | 0    |

PLS - Pools

LGR - Low gradient riffle

HGR - High gradient riffle

CAS - Cascades

RUN - Runs

BRS - Braided





### Trout Density Estimates

Cutthroat trout density in Buck Creek was 7.3 fish/100 m<sup>2</sup> for all habitat types combined (Table 16). Pool habitat contained an average of 14 cutthroat trout per 100 m<sup>2</sup>. In August 1990, biologists estimated mean cutthroat trout density in Buck Creek pool habitat to be 22 fish/100 m<sup>2</sup>. Timing of the survey, July 1991 and August 1990, accounted for the different mean densities.

In the other tributaries of the Little North Fork Clearwater River mean cutthroat trout densities ranged from 4 to 21 fish/100 m<sup>2</sup> in all habitat types (Table 16). In these same tributaries, mean cutthroat trout densities ranged from 5 to 29 fish/100 m<sup>2</sup> in pool habitat. Apperson et al. (1988) reported cutthroat trout densities for fish >70 mm ranged from 0 to 9.6 fish/100 m<sup>2</sup> in tributaries of the Coeur d'Alene River, 0 to 44.3 fish/100 m<sup>2</sup> in tributaries of the St Joe River, and 0 to 12 fish/100 m<sup>2</sup> in tributaries of the St Maries River.

We have not been able to demonstrate any relationship between timber harvest or stream habitat conditions and cutthroat trout densities in these six study streams in the Little North Fork Clearwater River drainage. These streams may not have been at maximum capacity. Other factors, i.e. overharvest of cutthroat trout downstream in the North Fork Clearwater drainage, may have masked the effects of timber harvest and road building on trout densities.

Hayden Creek, which was closed to fishing, was considered at maximum capacity for cutthroat trout. Gamblin (1988) reported cutthroat trout densities of 46.7 and 56.6 fish/100 m<sup>2</sup> in Hayden Creek in 1985 and 1986, respectively. The density estimates for the six study streams were all less than 500 of the values reported by Gamblin indicating that these six streams may be underseeded.

The data reported by Gamblin demonstrated the variability of trout density estimates from year to year. Several years of data may be needed to determine the true range of trout densities. Therefore, the one density estimate for each of the study streams was not enough to develop a true picture of the trout populations.

The low number of trout counted in Buck Creek may have been affected by timing of the sampling as well as overharvest of trout downstream. The water level in July 1991 was still affected by snowmelt runoff and had not reached summer base flows. The higher water flow did reduce the amount of habitat classified as pool habitat. Habitat that was as a run or riffle in July would have been classified as a pool at lower water levels.

Inadequate sample size may have biased the trout density estimates. A more systematic approach, similar to the one described by Hanken and Reeves (1988), may be necessary to reduce the possibility of bias.

The method used to survey the habitat in the Little North Fork Clearwater River may be general to detect the relationship between habitat and fish density. A different method may have to be developed to determine the most critical factors limiting trout abundance.

Table 16. Density estimates for westslope cutthroat trout in Buck, Adair, Rutledge, Twin, Montana, and Spotted Louis creeks, July 1991.

| Stream              | Area (m <sup>2</sup> ) | Number of<br>fish counted | Fish/m <sup>2</sup> | Fish/100 m <sup>2</sup> |
|---------------------|------------------------|---------------------------|---------------------|-------------------------|
| Buck Creek          | 2,020.5                | 149                       | 0.07                | 7.3                     |
| Adair Creek         | 272.4                  | 10                        | 0.04                | 4.0                     |
| Rutledge Creek      | 344.5                  | 28                        | 0.08                | 8.0                     |
| Twin Creek          | 79.3                   | 9                         | 0.11                | 11.0                    |
| Montana Creek       | 627.5                  | 107                       | 0.17                | 17.0                    |
| Spotted Louis Creek | 207.0                  | 44                        | 0.21                | 21.0                    |

### **RECOMMENDATIONS**

1. Determine stability rating for Adair, Rutledge, Twin, Montana, and Spotted Louis creeks using the 30 count method.
2. Monitor effects of continued harvest of timber and road building on stream stability, fish habitat, and fish density in Adair, Rutledge, Twin, Montana, and Spotted Louis creeks.
3. Recommend a moratorium on timber harvest in Adair, Rutledge, and Twin creeks until fish populations have increased to levels similar to Spotted Louis Creek.
4. Monitor changes in fish habitat and stream channel stability caused by road building and logging in Section 11 in the headwaters of Buck Creek.

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## **A P P E N D I C E S**

Appendix A. Forms used to record habitat evaluation measurements.

**Stream** \_\_\_\_\_

**Form #** \_\_\_\_\_

## Forest

District \_\_\_\_\_

Page \_\_\_\_\_ of \_\_\_\_\_

Channel Reach Type \_\_\_\_\_ Gradient \_\_\_\_\_ Discharge \_\_\_\_\_ Date \_\_\_\_\_

[illegible]



**RIFFLE ARMOR STABILITY INDEX FORM**

**District:** \_\_\_\_\_  
**Stream:** \_\_\_\_\_  
**Surveyors:** \_\_\_\_\_  
**Date:** \_\_\_\_\_ **Rosgen Channel Type:** \_\_\_\_\_  
**R/1(Pfancuch) Stability Rating:** \_\_\_\_\_  
**Gradient:** \_\_\_\_\_ **Cross Section Location & ID:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

| PEBBLE TALLY       |                |       |
|--------------------|----------------|-------|
| SIZE mm            | DOT/DASH COUNT | TOTAL |
| <2                 |                |       |
| 2-4                |                |       |
| 4-8                |                |       |
| 8-16               |                |       |
| 16-32              |                |       |
| 32-64(2-5")        |                |       |
| 64-127(5-10")      |                |       |
| 127-254(10-20")    |                |       |
| 254-508(20-40")    |                |       |
| 508-1016(40-80")   |                |       |
| 1016-2032(80-160") |                |       |

**NOTES:**

Appendix A. Continued.

**Submitted by:**

James A. Davis  
Regional Fishery Biologist

Ned Horner  
Regional Fishery Manager

**Approved by:**

IDAHO DEPARTMENT OF FISH AND GAME

A handwritten signature in black ink, appearing to read "Steven M. Huffaker", written over a horizontal line.

Steven M. Huffaker, Chief  
Bureau of Fisheries

A handwritten signature in black ink, appearing to read "Bill Hutchinson", written over a horizontal line.

Bill Hutchinson  
State Fishery Manager